CIRCULATES IN EVERY PROVINCE IN CANADA

CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper devoted to the manufacturing interests, covering in a practical manner the mechanical, power, foundry and allied fields. Published by the MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg and London, Eng.

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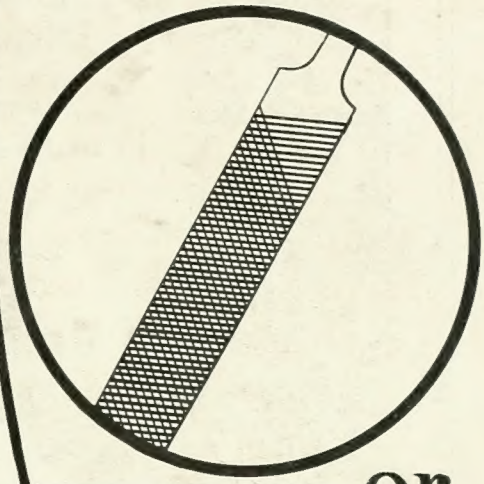
WHICH DO YOU WANT TO SAVE



The Man— ? —or The File

ONE DAY of this skilled man's time pays for a DOZEN new files.

Yet—by using WORN files (their best efficiency past)—your skilled man can easily WASTE A DAY A WEEK.

Figure out for yourself the most profitable plan:

To LET your men WASTE TIME with worn files—

Or—

To MAKE them SAVE TIME by discarding worn files promptly.
By using only new, EFFICIENT files like the FAMOUS FIVE:

KEARNEY & FOOT **GREAT WESTERN**
AMERICAN **ARCADE** **GLOBE**

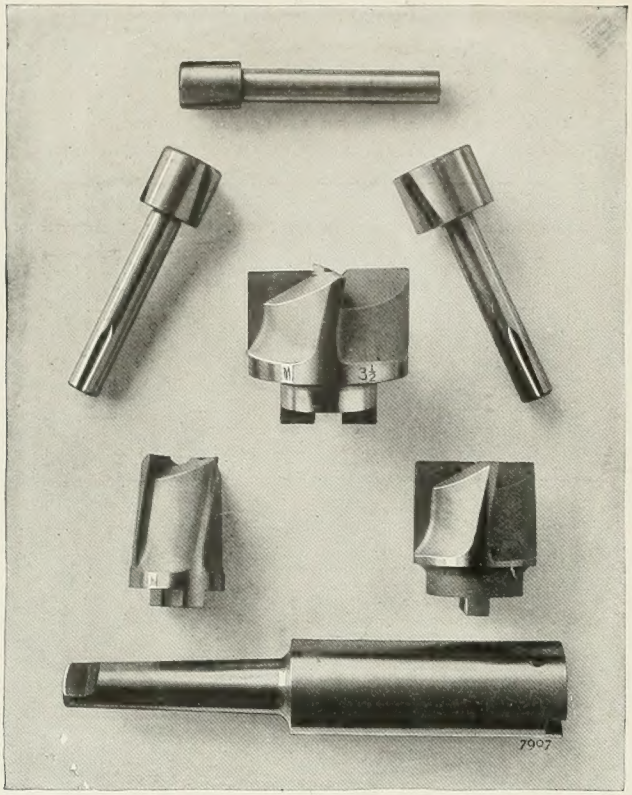
(Made in Canada)

50 years' experience. 60,000,000 yearly output. Five great plants. Complete control of every process—from steel to file. *These* make the "Famous Five"—WORLD-STANDARD FILES.

NICHOLSON FILE COMPANY

PORT HOPE (Dealers Everywhere) **ONTARIO**

Make Your Own Combination



For every counterboring job you can make immediately the right combination of holder, cutter and guide if your tool room is equipped with

P. & W. Interchangeable Cutter Counterbores

Holders, Cutters and Guides furnished in wide range of sizes.

Holders

End of holder is milled to receive the driving lug of the cutter and there is also a hole and set screw to accommodate the shank of the guides.

Guides

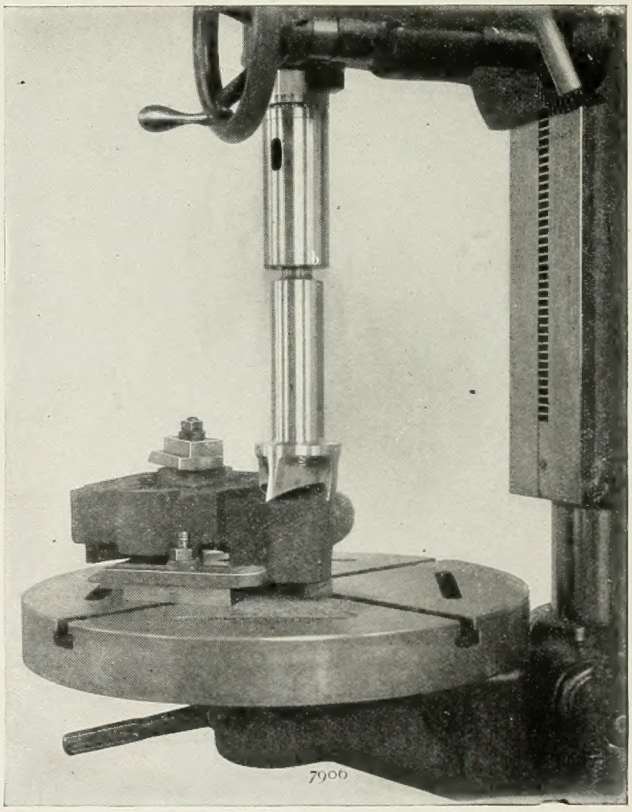
Are of hardened tool steel. They are held in place by means of a set screw in the holder engaging a V-slot in the shank of the guide.

Cutters

Can be furnished of either carbon or high speed steel.

The shank of the guide passes through the hole in the cutter and the shoulder between the guide and its shank keeps the cutter in place. Cutters can be sharpened on the face and the guide is simply pushed further in the hole after grinding.

Write for catalog "Small Tools" showing our complete line.



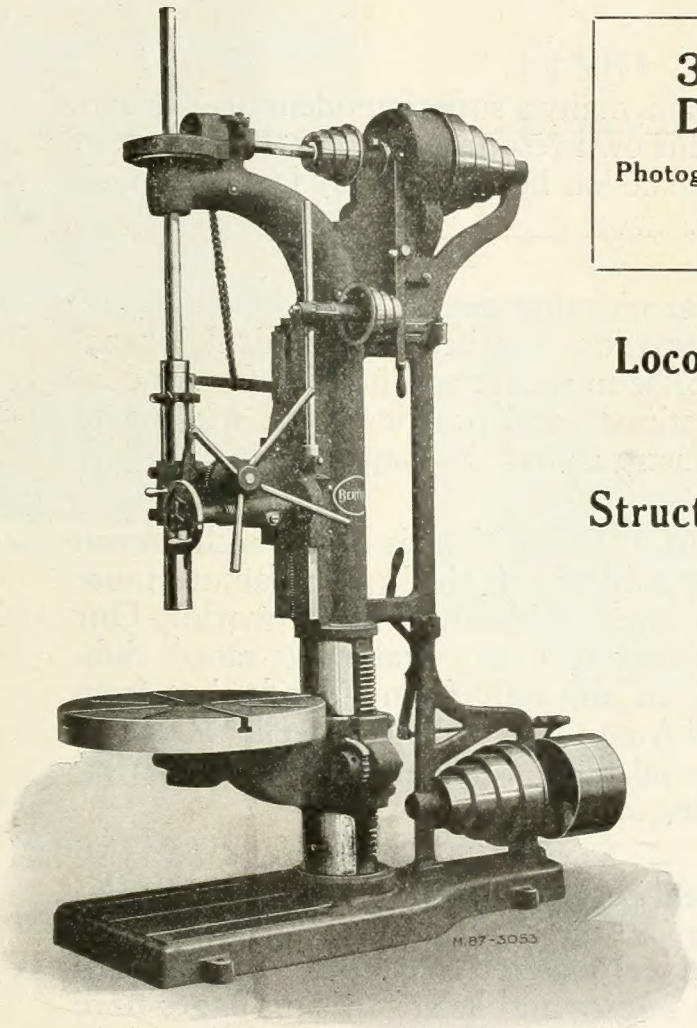
Spot Facing
with a P. & W. Interchangeable Cutter Counterbore

Place a trial order with our nearest store.

Pratt & Whitney Company of Canada, Limited

DUNDAS	MONTREAL	WINNIPEG	VANCOUVER
Ontario	723 Drummond Bldg.	Bank of Hamilton Bldg.	B.C. Equipment Co.

BERTRAM
MACHINE TOOLS



30-inch Vertical Drilling Machine

Photographs and full particulars gladly mailed upon request.

WRITE US NOW.

Locomotive and Car Shop Equipment

Structural and Bridge Shop Machinery

Repair Shop Machinery

General Machine Shop Equipment

The John Bertram & Sons Co.

Limited

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MONTREAL
723 Drummond Bldg.

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The Publisher's Page

By B.G.N.

The Friend in Need

¶ Many a business man, many a superintendent or foreman, has been thrown on his own resources during the last six or eight months, or since he has been so closely identified with shell manufacturing.

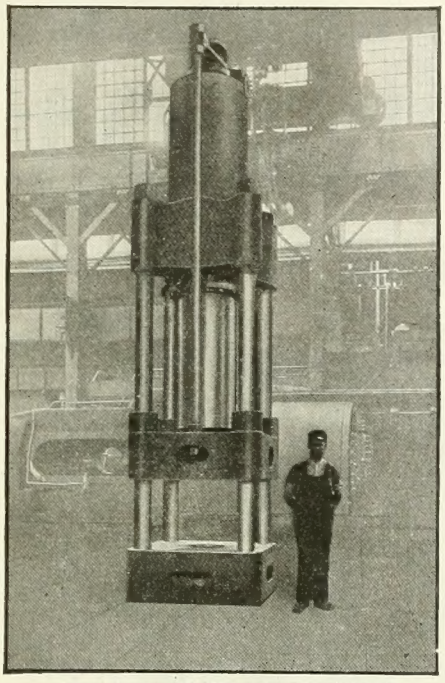
¶ It has been well for him that one of his chief resources, and sources of information, has been a technical journal with sufficient enterprise to secure and publish for his convenience so much intimate and practical data relating to Canada's newest industry as has this paper.

¶ CANADIAN MACHINERY, as is now a well-known fact, has covered the subject of shell manufacture more thoroughly than any other publication in the world. Our circulation has increased at a very gratifying rate. Subscriptions have come in, not only from Canada, but from the United States and from Great Britain as well. Requests for copies of this special Shell Number have been pouring in ever since it was first announced.

¶ The service, the real service CANADIAN MACHINERY gives its readers all the time—in war time and peace time—has only been emphasized recently. In ordinary practice the editorial service and its advertising pages have been appreciated, but it took an *Emergency* to bring right home the real value of a first-class technical paper.

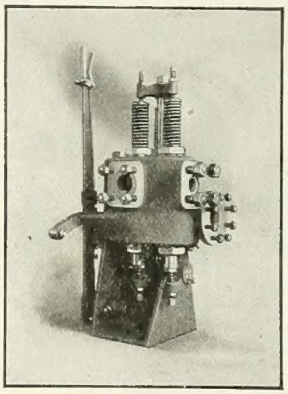
Canadian Machinery and Mfg. News
143-153 UNIVERSITY AVE. .:. .:. TORONTO, ONTARIO

QUICK DELIVERIES
OF
PRESSES AND ACCUMULATORS
ALL TYPES AND SIZES



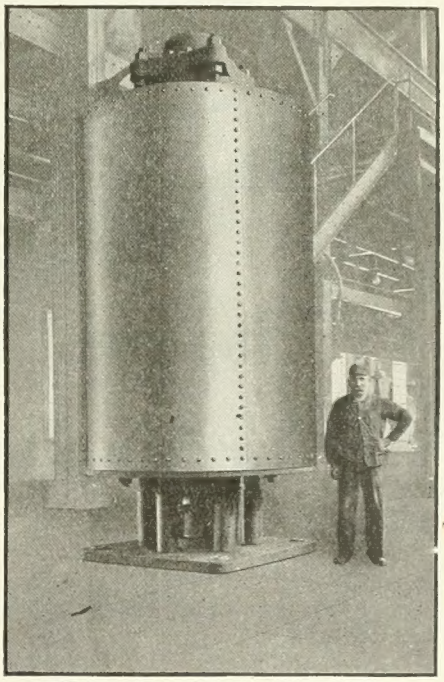
300-TON HYDRAULIC PRESS

HYDRAULIC PRESSES
FOR
PIERCING, DRAWING,
FORGING, CUPPING,
ETC.



PRESS OPERATING VALVE

ACCUMULATORS AND
OPERATING VALVES FOR
HYDRAULIC SYSTEMS.



HYDRAULIC ACCUMULATOR

MESTA MACHINE COMPANY
PITTSBURGH, PA., U.S.A.

DESIGNERS AND BUILDERS
GAS AND STEAM ENGINES, ROLLING MILL MACHINERY, SHEARS, SAWS, ETC.

Great Strength, Uniformity, Elasticity and Toughness—combined with the ability to take Deep Cuts at High Speeds—while preserving a wonderfully keen cutting edge for long periods are qualities found only in

Red Cut Cobalt

The Best High Speed Tool Steel For Machining all Hard Materials

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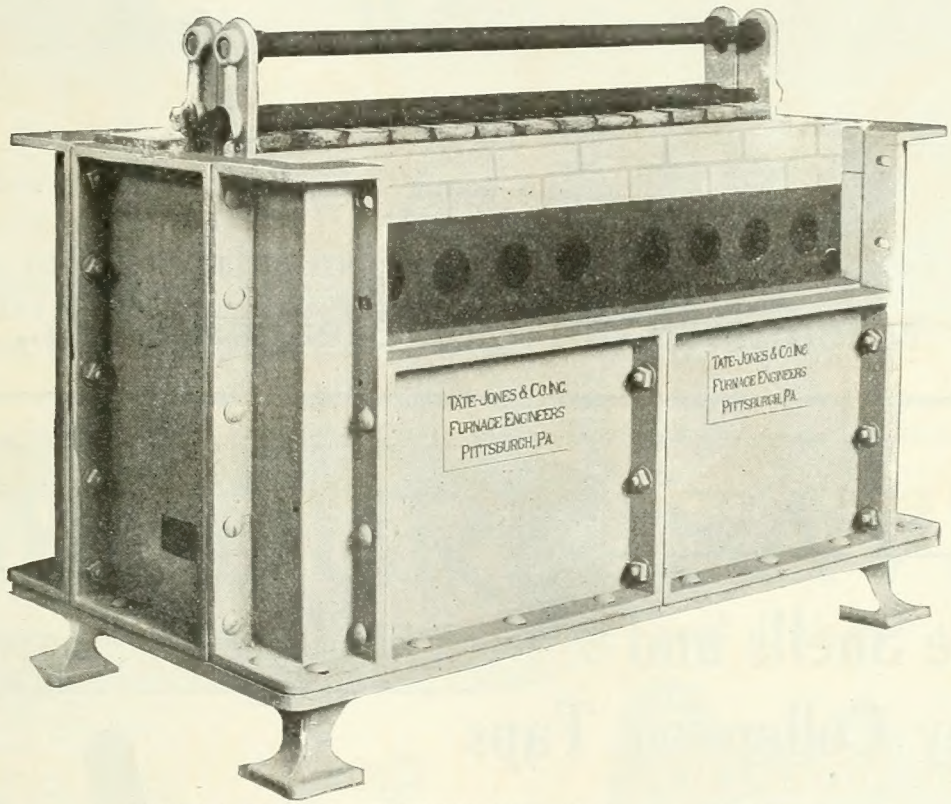
Manufactured only by

Vanadium-Alloys Steel Company

PITTSBURGH, PENNA.

FOR NOSING
LYDDITE SHELLS
USE
TATE-JONES FURNACES



TATE-JONES FURNACE FOR 4.5 SHELLS

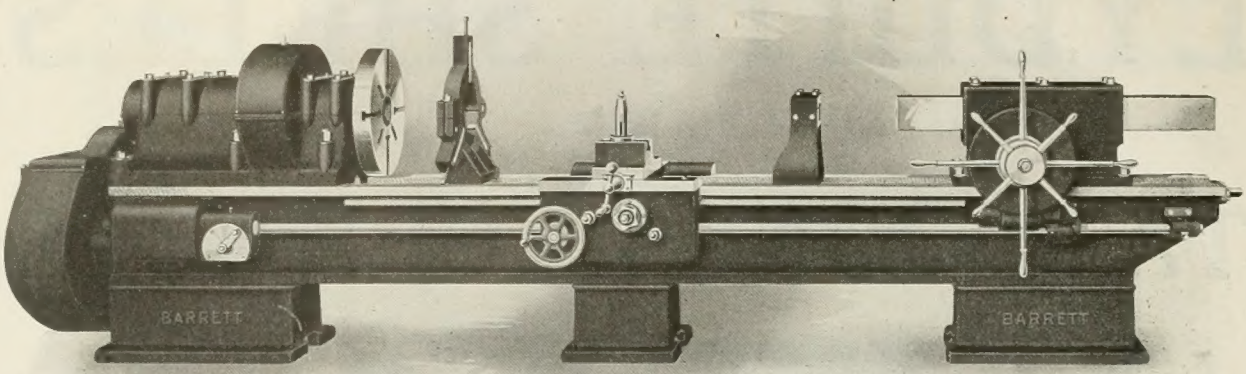
Are the furnaces you are using giving you maximum OUTPUT for the amount of fuel burned and the floor space occupied?

Correctly designed furnaces will maintain your output and reduce your fuel consumption.

Tate-Jones furnaces for all forging and heat-treating operations on Shells, and Tate-Jones continuous furnaces for the annealing of cartridge cases will give you maximum output and reduce your fuel consumption.

TATE-JONES & COMPANY, Inc., PITTSBURGH, PA.
FURNACE ENGINEERS

Barrett 25" Heavy Duty Projectile Boring Lathe

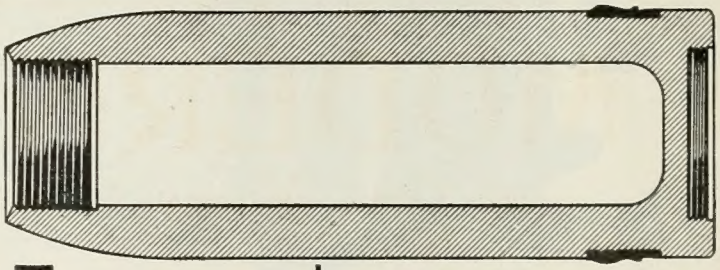


A thorough tried-out proposition for boring and facing projectiles and shells up to 12 inches.

LET US SEND YOU SPECIFICATIONS AND FULL PARTICULARS.

Barrett Machine Tool Co., Meadville, Pa., U.S.A.

Lyddite Shells and Murchey Collapsing Taps

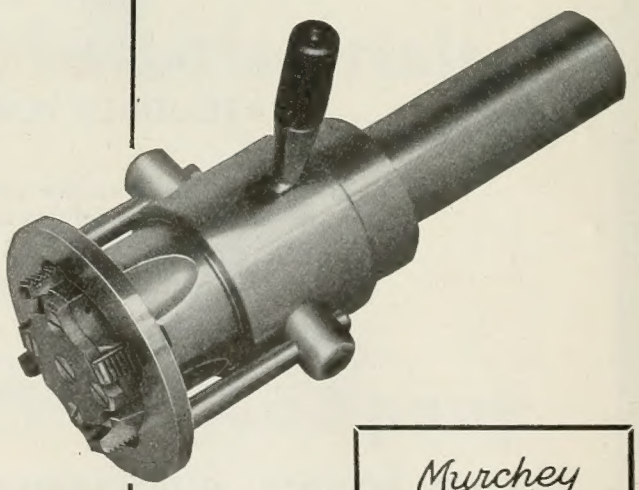


are linked together because Murchey Collapsing Taps are being used to great advantage in connection with the manufacture of shells of this type.

Shrapnel manufacturers are finding Murchey Collapsing Taps a big asset in the production of shrapnel in large quantities and at low cost. The advantages in using collapsing taps on shrapnel show in convenience, time-saving, speed and accuracy.

When as many as 150 Murchey Collapsing Taps are ordered by one manufacturer it's time you looked into the matter of applying Murchey Collapsing Taps to *your* business.

Write and let us send you our Catalog.



Murchey Machine & Tool Co.
64 Porter Street, Detroit, Mich.

Murchey Service
will show you exactly where and how much you can save by using Murchey Tools. Send us your blueprints.

KEMPSMITH

PLAIN MILLERS

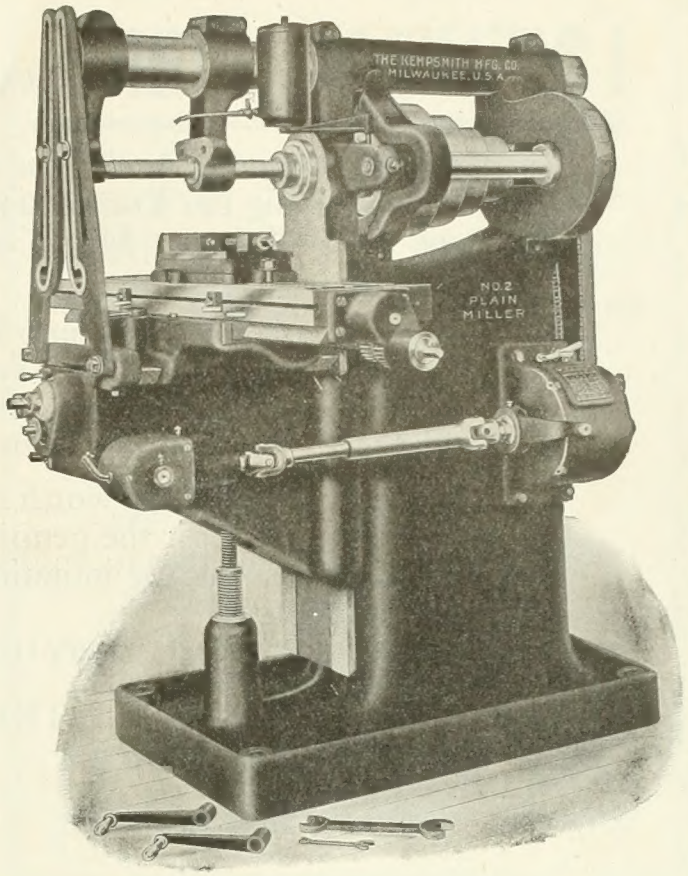
Built in Four Sizes Knee Type

Two Sizes Lincoln Type

These milling machines are characterized by simplicity of operation, rigidity of design and highest accuracy in construction.

Our literature on the construction and use of Milling Machines will be found interesting and suggestive. Sent gladly on request.

KEMPSMITH MFG. COMPANY
MILWAUKEE, WIS.



A MODERN SAVER

of Time, Money, Space and Labor

Here is a machine that is well worthy of your attention — our "**Double C Punch and Shear**" with 48-inch throat.

This machine has an enormous capacity for doing **rapid, accurate** and **economical** work of **quality.**

Let us send full description. If you are interested in up-to-date money-saving machinery you cannot afford to remain uninformed.

We manufacture a complete line of

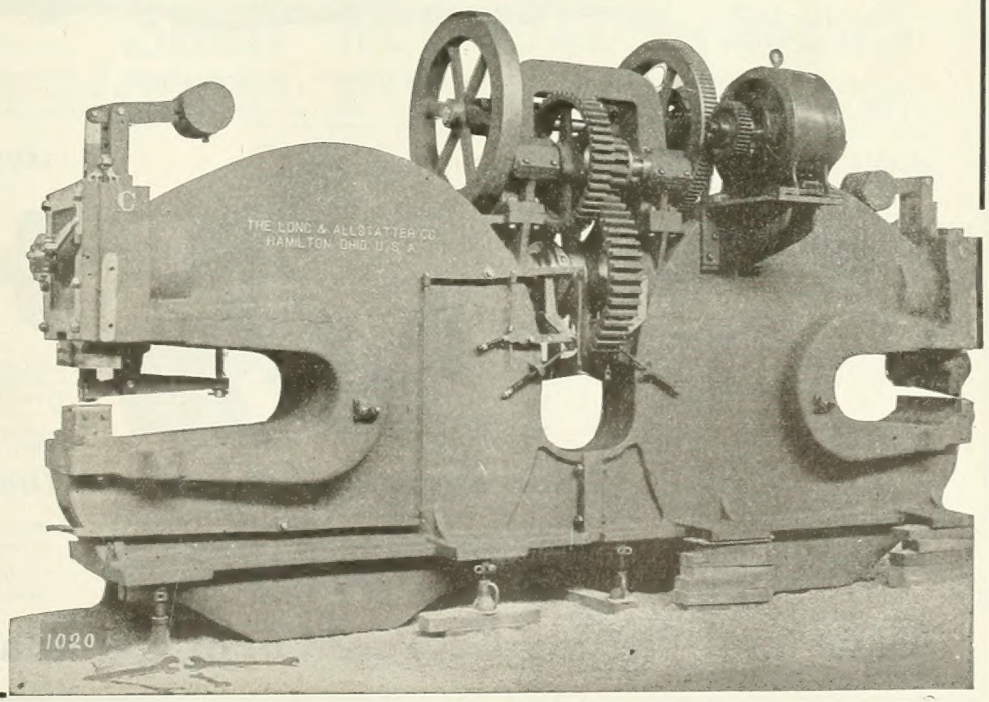
LABOR-SAVING MACHINERY

all kinds and sizes, for

Structural Iron Works, Railroad and Locomotive Shops, Boiler Shops, Rolling Mills, Agricultural Implement and Plow Shops, etc.

The Long & Allstatter Co.
HAMILTON, OHIO

Canadian Representatives
RUDEL-BELNAP CO.
Montreal, P.Q. Toronto, Ont.



If what you want is not advertised in this issue consult the Buyers' Directory at the back.

TO THE USER OF WRENCHES

Users of Wrenches, both Pipe and Monkey Wrenches, will find economy in buying the Trimo makes. A new standard of quality has been set by Trimont Mfg. Company, the makers of these improved wrenches.

Be sure to ask for the Trimo Wrenches, both Pipe and Monkey, which are all-steel goods. They are equipped with Nut Guards that prevent the accidental turning of the adjusting nut in close quarters, and with Steel Frames, in the principal sizes that will not break.

These new Trimos are worth more to the user because of these improvements. Ask for the genuine and take no other. Don't let unfair dealers pass out the imitation on you. The name Trimo is on every Trimo tool.

Very truly yours,

TRIMONT MFG. COMPANY,

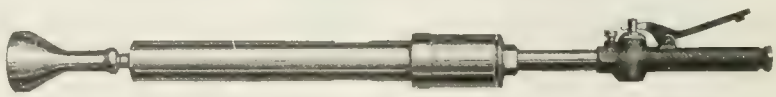
Roxbury, Mass.

Canadian Foundrymen are cordially invited to make their headquarters at our Booth, Spaces No. 118 and 120 Machinery Hall, The Foundry and Machine Exhibition, Young's Pier, Atlantic City, September 25th to Oct. 1st. Works Managers and Superintendents will find much that will interest them in our Complete Line of Air-Tools for Foundry Service. All visitors will be welcome at our Display and may arrange to meet their friends there.

CLEVELAND SAND RAMMERS FOR GENERAL FOUNDRY WORK

Size No. 4F For Floor Work

Size No. 1HF For Flask Work

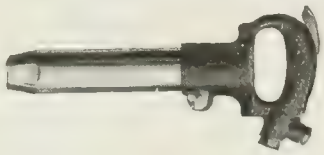


Size No. 1H For Bench Work

Size No. 1H For Core Work

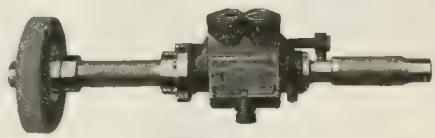
Cleveland Rammers have high speed and little or no vibration. They are simple in construction, and have less parts than any similar type of Rammer. They require less frequent renewal of packing, which is adjustable and excludes all dirt. They have no delicate parts to cause trouble, delay and expense. They are efficient and economical, and the cost of upkeep is very moderate. They are fitted with round or flat rod; the flat rod prevents rein from turning.

CLEVELAND CHIPPING HAMMERS



The simplicity of construction of Cleveland Hammers make them "ideal" for Foundry Service. They are dirt-proof, have high speed and little or no vibration. Their fast cutting qualities appeal to the operator, as they increase the output.

CLEVELAND PORTABLE GRINDERS



Adapted to grinding grey iron or steel castings or for any work requiring a Portable Grinder. Made in two sizes, No. A and AA; speed 3,300 and 2,700 R.P.M. respectively. Wheel guards furnished with either size grinder.

BOWES AUTOMATIC AIR HOSE COUPLINGS

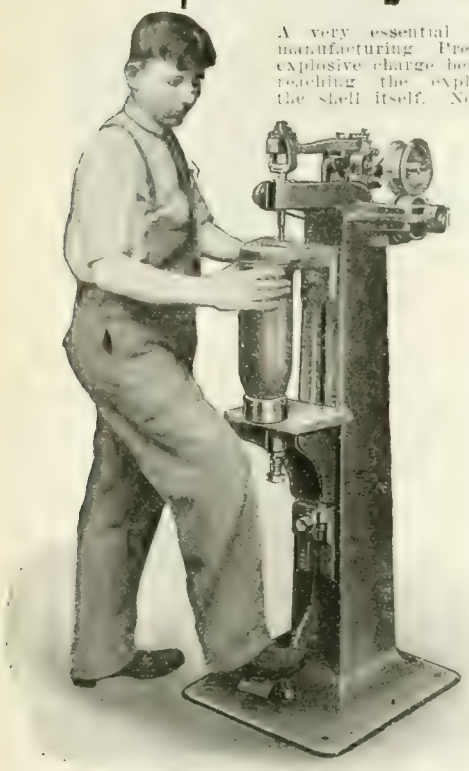
Over 1,000,000 in general use.

The Bowes is instantly connected or disconnected. They are Air-Tight under all pressures.

Adjoining cut shows the Hose attached to Bowes Coupling with Never-Slip Hose Clamp. No "blow-offs" can occur if the Never-Slip Clamp is used.

Cleveland Pneumatic Tool Co. of Canada, Ltd., 80 Duchess Street Toronto, Ont.

Riveting Base of Explosive Projectile



A very essential operation in shell manufacturing. Prevents gas from the explosive charge behind the shell from reaching the explosive contents of the shell itself. Neglect of this operation would probably cause the shell to explode and kill or injure the gun crew. After the shell is in position the machine is started and the shell is rotated one complete revolution by hand and, with the machine striking about 2,000 blows per minute, the plug can be riveted perfectly tight into the base in about 10 seconds. CHANGE OF FIXTURE ENABLES MACHINE TO BE ADAPTED FOR 4.7", 18 LBS. OR SHELLS EVEN LARGER THAN 4.5".

Drop a line for further particulars.

The Grant Mfg. and Machine Co.

Bridgeport, Conn.

SHELL MAKERS!

Are you CUTTING your shell stock and blanks by the **Oxygen Process?**

By means of a simple jet of Oxygen played on the metal, you get quicker cuts for less cost. You can increase your output and have a more dependable cutting apparatus.

ASK US!

LEVER BROTHERS, LTD.

Oxygen Department - - TORONTO

Hydraulic Presses

for

Shell Manufacturing

PIERCING PRESS

We are making

HYDRAULIC PRESSES

for Piercing and Drawing

Shells and Projectiles

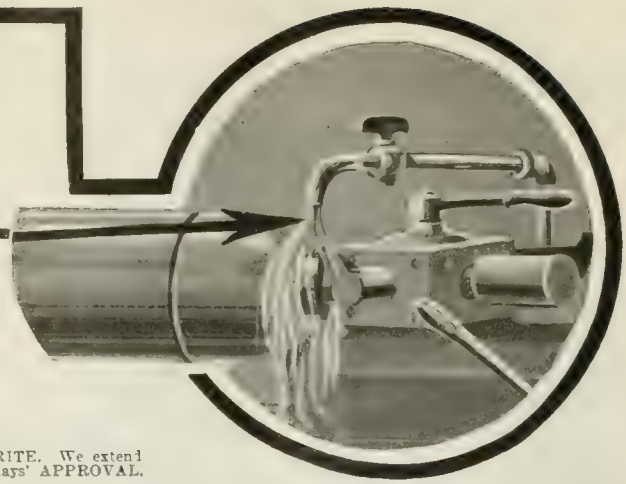
and are in a position to give

Prompt Delivery

The William Cramp & Sons Ship and Engine Building Company

PHILADELPHIA, PA.

JUSTRITE
CUTTING LUBRICANT



A Manufacturer Producing 3000 Shrapnel per Day Uses JUSTRITE Because

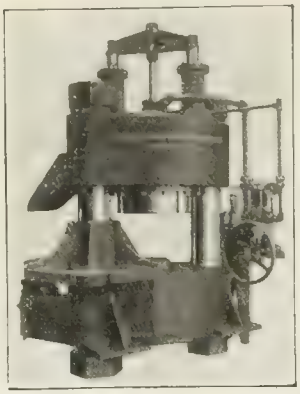
(1) He gets a higher speed in turning operations.
(2) Greater feeds.
(3) Fewer Grindings of cutting tools—a saving of time and cutting tools.
(4) A clean, bright thread—ragged edges unknown.
(5) Shrapnel is left clean and polished.
(6) No smoke or obnoxious odors about the shop.

To meet the present exigency we announce the ability to make immediate shipment of any quantity.

A number of the largest Shell Manufacturers in Canada have placed orders for JUSTRITE. We extend the invitation to EVERY Shell Manufacturer in the Dominion to order a barrel on 30 days' APPROVAL. Write for yours now.

Crescent Oil Company, 30 Church St., N.Y. City.

Also Mfrs. of "Aqualene" Scientific Cutting Lubricants, and "Duocene" Semi-Soluble Oil.



ELMES HYDRAULIC PRESSES

Rapid-acting hydraulic drawing presses, piercing presses, pumps, and accumulators for making Shells, etc. High pressure fittings and valves, quick shipment.

Send for our illustrated catalog to-day

Charles F. Elmes Engineering Works

217 N. Morgan Street, Chicago, U.S.A.

Over 50 years' experience building hydraulic machinery.

THE Carbic Régd LIGHT

WAKEFIELD'S PATENTS

BRIGHT AS SUNLIGHT

TURNS NIGHT INTO DAY

THE CARBIC FLARE LIGHT
2,000 C.P.

Indispensable for Construction Work, Railroad Auxiliaries, Foundries, Mines, etc.

Absolutely Non-Explosive. Easy to Operate. Nothing to Get Out of Order. Can be Re-charged in a Minute.

Made in two sizes:

No. 1, Burns 6 hours.
No. 2, Burns 12 hours.
Takes No. 20 Carbic Cake.

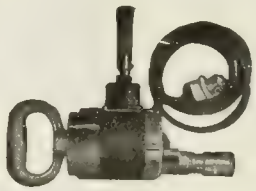
Absolutely the most economical lamp on the market to-day.

W. L. FOSTER

8 LOMBARD ST., TORONTO, CAN.

U. S. Electric Drills and Grinders

Save Time, Labor and Money



They can be attached to any lamp socket.

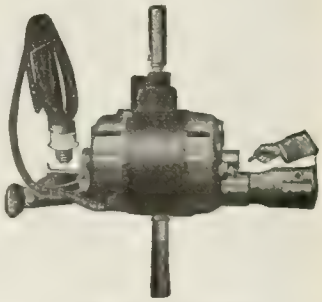
For drilling in metal they are superior to any other kind of portable drill. Cost 50% less to run than air drills.

2 SIZES.

3-16	inch,	W.G.T.	6 lbs.
¼	inch,	W.G.T.	9 lbs.
⅜	inch,	W.G.T.	12 lbs.

All motors wound for 110 or 220 volts. Direct or alternating current.

Try a few of our Electric Drills and Grinders and you'll send us an order for more. Our guarantee protects you.



½ inch—2 SPEED.
Speed, 400-750 R.P.M.

For Sale By

The Canadian Fairbanks-Morse Co., Limited

Montreal. St. John, N.B., Toronto. Winnipeg. Calgary. Vancouver.

THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO

Why go to the expense of buying new machines for the manufacture of

SHELLS?

We have already shipped some 75 carloads of

Rebuilt Machine Tools

to CANADA since the outbreak of the war, with absolute satisfaction in each case.

If you need any equipment it will be to your advantage to get in touch with us as our facilities for furnishing rebuilt machinery are second to none on the continent.

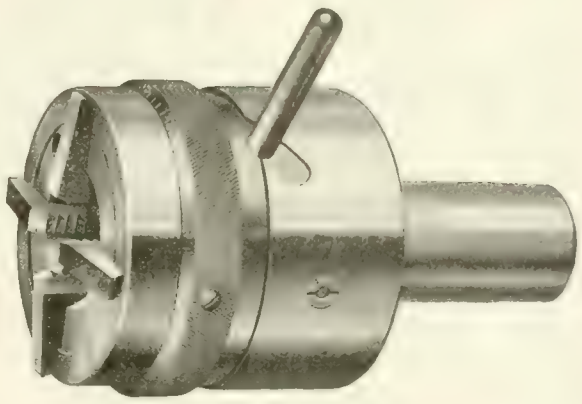
EVERY MACHINE WE BUY IS PUT THROUGH OUR OWN SHOPS AND COMES OUT IN ABSOLUTELY PERFECT ORDER—AND WE STAND BEHIND EVERY ONE WE SELL.

The demand is enormous, but we are not taking advantage of the war by putting on exorbitant prices—our aim is a good, square deal to everybody all the time. You can often get something practically equal to a new machine at a very great saving in price.

As we carry a large stock, we can likely supply you from stock, or if we cannot do this, we will take your order for future delivery, specifying a definite time when we will supply you with such tools as you may require.

New York Machinery Exchange
50 Church St., New York

Good Threads Cost Less Than Poor Ones



Wells Self-Opening Die—Model B.

The advent of the W.S.O.D. in his shop, has opened the eyes of many a manufacturer producing screw threads to the fact that he can

Increase Production Decrease Costs and Cut Perfect Threads

all at one and the same time.

Do you want us to prove it? We are ready.

We want to send you the booklet describing the different models. Are you willing to try the W.S.O.D. in your shop under your own conditions?

Wells Brothers Company
of Canada, Limited
GALT - ONTARIO

Sales Agents:
The Canadian Fairbanks-Morse Co., Limited, Montreal, Toronto, Vancouver, Winnipeg, St. John, Calgary.

SPRINGS, WIRE & STEEL
THE WALLACE BARNES CO.
ESTABLISHED
"BARNES-MADE" PRODUCTS
1857
BRISTOL CONN. U.S.A.
SCREW MACHINE PRODUCTS

SPECIAL SPRINGS

AND

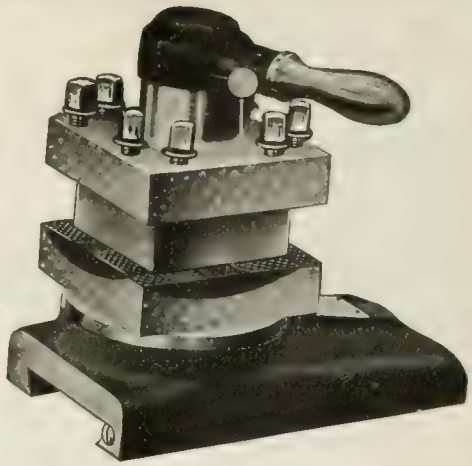
Screw Machine Products

MADE ON CONTRACT

to the most exacting specifications, and deliveries made as desired.

Ask for Booklet 6-T.

Established 1857.
THE WALLACE BARNES COMPANY
218 SOUTH STREET, BRISTOL, CONN., U.S.A.
Manfrs of "Barnes-made" Products
Springs, Screw Machine Products, Cold Rolled Steel and Wire



Particularly Adapted to the Manufacture of Shrapnel

Your Lathe Needs A NEW TOOL POST, One of the Modern Multiple Type.

You can no longer afford to use the old style single tool holder.

Give us the size of the dovetail on your lathe carriage and height to lathe center; we will quote you price on a Modern Tool Holder that we guarantee will increase your production, and give you some interesting facts about Lathe Turrets.

No matter what make or size of lathe—we can fit it.

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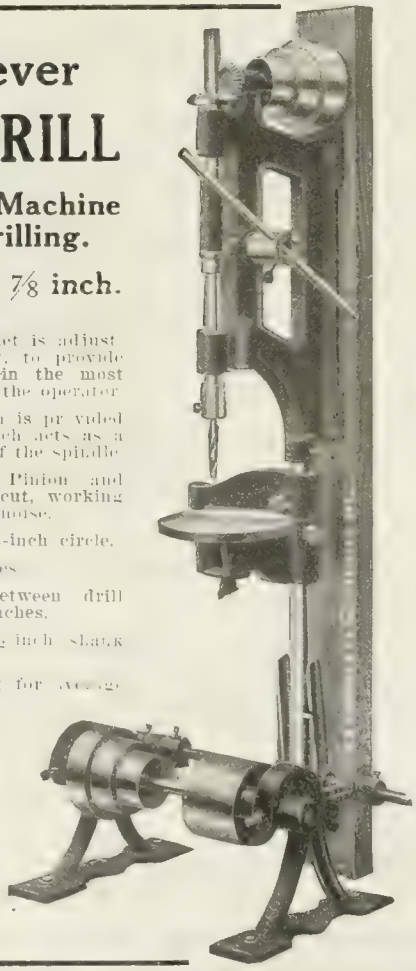
Will drill up to 7/8 inch.



The Feed Lever Socket is adjustable on the feed shaft, to provide for setting the lever in the most convenient position for the operator.

An adjustable friction is provided for the feed shaft, which acts as a balance to the weight of the spindle.

Bevel Gears, Feed Pinion and Rack are all machine cut, working smoothly and without noise.

Drills to centre of 16-inch circle.

Run of feed 5¼ inches.

Greatest distance between drill spindle and table, 23 inches.

Spindle bored for ½ inch shank twist drills.

Speed of countershaft for average work, 300 per minute.

A. B. Jardine & Co.

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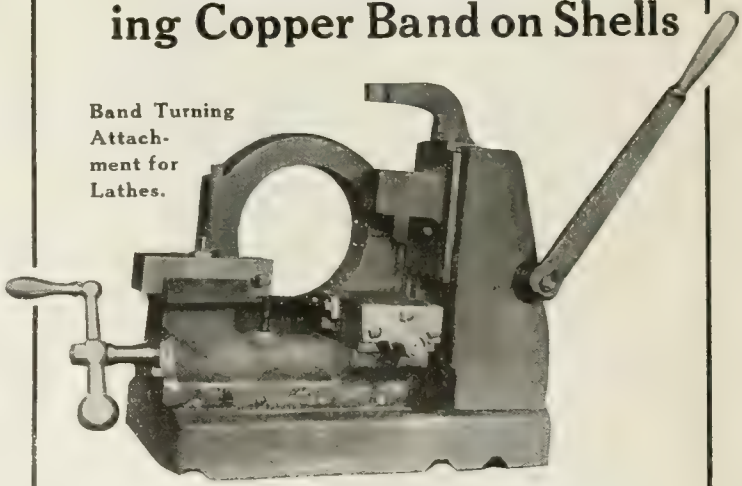
Band Turning Attachment for Lathes.



This attachment will fit any engine lathe, and with its use you can turn the copper band on Shrapnel Shells down to size required and burnish them *all in one operation.*

With this device we will guarantee an output of

50 Turned Copper Bands per Hour

Used with a specially constructed steel chuck, casting of which can be finished on the lathe on which the attachment will be used.

Castings are supplied by us.

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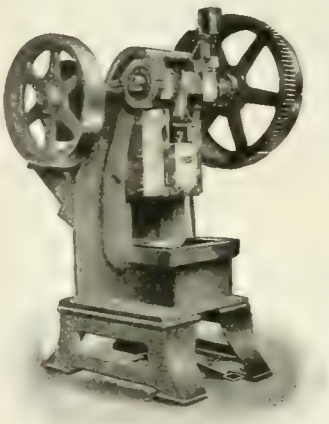

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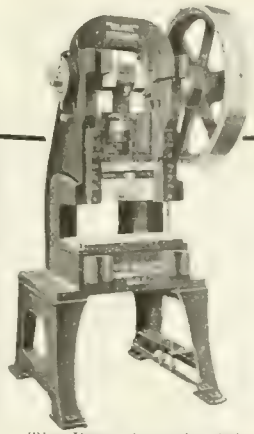

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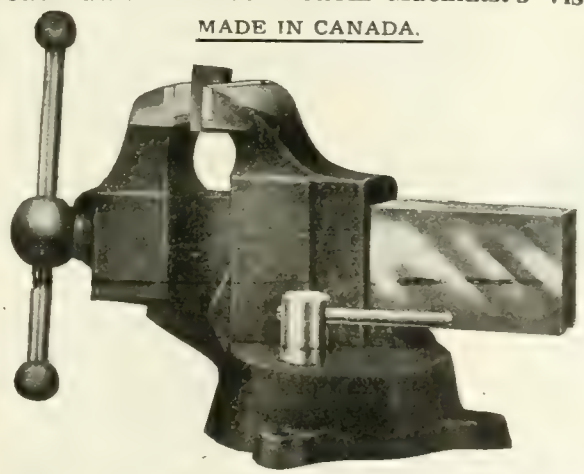

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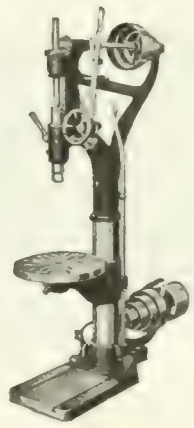

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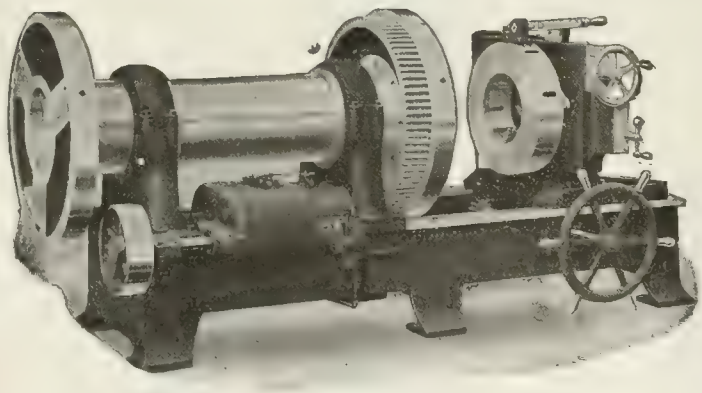

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With your plant equipped with suitable machines from this line, you can cut and thread pipe month after month and year after year. Continuous, satisfactory performance in a pipe machine is a question of rugged construction. There is nothing more discouraging than to have a machine start off well, and then rapidly fail and go to pieces.

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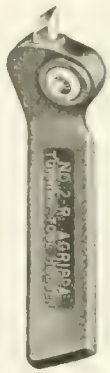
THE HIGHEST AWARD, "THE MEDAL OF HONOR" FROM THE PANAMA-PACIFIC EXPOSITION, CONFERS TOOL HOLDER SUPREMACY UPON "AGRIPPAS."

Headless Cam



PROGRESSIVE Superintendents know the tremendous economy of tool holder use, but many of them preferred to forego the economy and escape the annoyance of set screw troubles and breakage delays.

We were gratified recently at receiving an order for a full line of

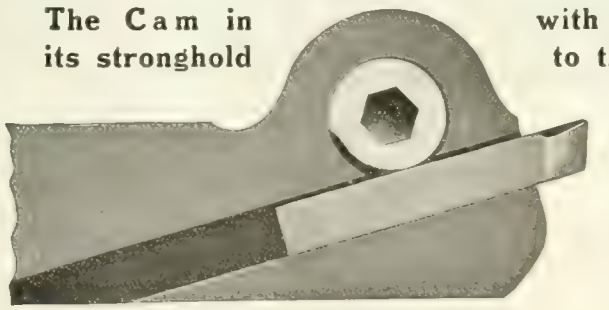
Williams' "AGRIPPA" Tool Holders

"THE HOLDERS THAT HOLD"

for Turning, Planing, Boring, Threading, Knurling, Cutting-off and Side Work from such a Superintendent and questioned him upon his change of heart.

He confessed

The Cam in its stronghold



with its back to the wall

had penetrated his blindfold, convincing him that cam fastenings are more serviceable than any other fastenings ever used in tool holders, because they can be made to grip tighter (the greater the pressure the tighter the lock) and because they cannot strip, upset, or "lose their heads."

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SINCE July, Nineteen Fourteen, this Spartan Belt has been pumping sulphuric acid fumes from the pickling room at the plant of the Halcomb Steel Co., Syracuse, N.Y.

The corrosion, as seen in the photograph, around the blower, indicates the action of the acid fumes and gives some idea of the unusual service conditions under which the Spartan Belt has operated.

This belt has not only withstood exposure to acid fumes for more than a year, but during that time has operated with absolutely no protection from weather extremes.

Notwithstanding the abnormal service conditions existing, Spartan has given perfect satisfaction, which is pretty convincing evidence that Spartan Belting is impervious to conditions which quickly ruin ordinary belting. Why not Spartan as a solution of your transmission problems?

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The advertiser would like to know where you saw his advertisement—tell him.

Production of Shells in a Plant Specializing in Cut Gears

Staff Article

Resourcefulness in gripping and mastering the details of shrapnel shell manufacture has not, as will have been noticed from our leading articles in this and recent issues, been confined to any particular section of Canadian mechanical engineering enterprise. The plant here featured, although not a leader in point of size, earns that distinction in its output.

PREVIOUS to taking up the manufacture of shells, the plant described in this article had been devoted exclusively to the production of cut gears. While the gear-cutting machines themselves were of no use in shrapnel work, the larger part of the shop equipment fitted in very closely with the new requirements. Considerable additional machinery was installed, but it was almost all of the same kind as that already in use, and merely represented such extensions as an ambitious factory manager might hope to add to such a plant during the next two or three years. The hardening room, which department has given so many shell makers a full measure of trouble, did not in this case require any changes except the addition of a larger soda water boiler and a larger quenching tank with circulating coils for cooling water.

The organization of this plant is based on a production of one completed shell every three minutes. The exact sequence of operations on 18-pounder shrapnel varies somewhat according to available facilities, but in a broad sense the general grouping of operations is similar in most plants.

The preponderance of Jones & Lamson flat turret lathes in this shop will be noted, as well as the fact that a number of these are of the double spindle variety, finishing two shells at each revolution of the turret.

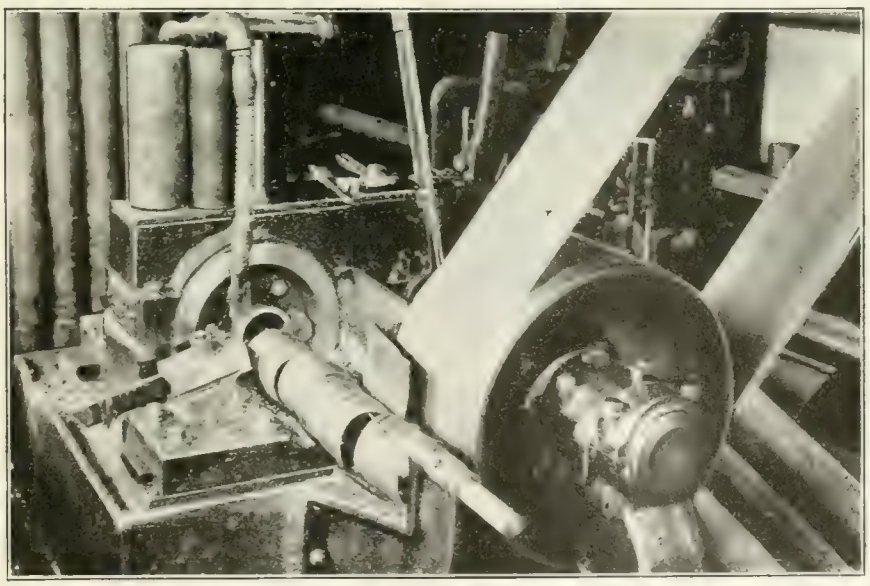


FIG. 1. "HAMILTON" CUTTING-OFF MACHINE

Referring to operation 1—cutting off—the machine in which this is done was designed and built by the Hamilton Gear & Machine Co., Toronto, and has been in demand from other shops since the shell business began to assume its present importance. The shell is encircled by an annular chuck with automatic jaws, which grip the shell body and leave both ends exposed. The shell is located by a stop rod, positioning from the inside of the base of the shell. Excess metal on the base of the forging is removed by one tool, while the open end is trimmed to the correct length by a cutting off tool. These tools are located on two separate slides, one on each side of the chuck, with different rates of feed (ratio about four to one) to suit their work. They thus automatically size the overall dimensions of the forgings. Owing to the great variation in the thickness of the bases of the rough forgings, it is sometimes necessary to take a very heavy cut, as much as five-eighths of an inch having been encountered. As indicated by the illustration, Fig. 1, ample belt power has been provided for this heavy work.

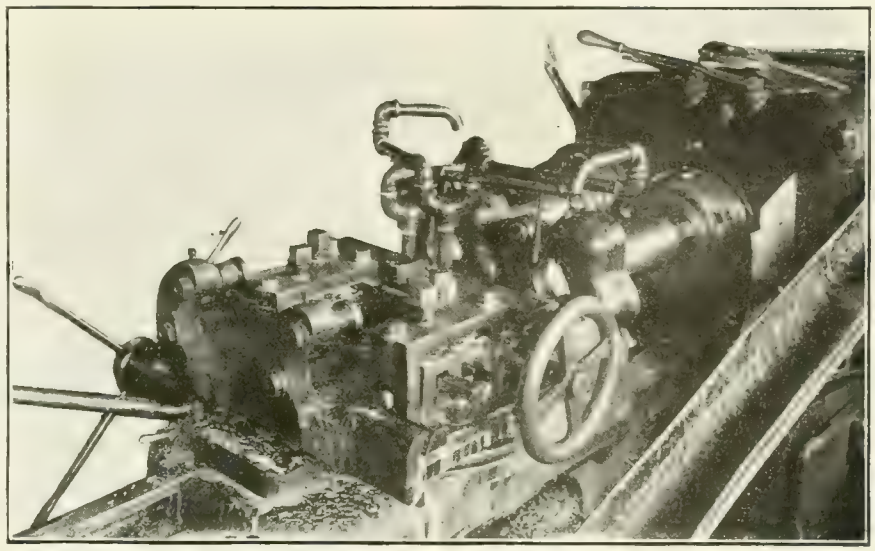


FIG. 2. DOUBLE SPINDLE LATHES EQUIPPED WITH UNIT TOOL BLOCKS.

Operation 2 includes rough turning the outside, finish face base, round off corner and machining groove. It is handled on two double spindle and one single spindle J. & L. flat turret lathes, size 3 in. x 36 in. The tool arrangement on these machines is decidedly interesting. That supplied by the machine builders was found capable of improvement, and a complete revision of the equipment resulted, as shown in Figs. 2 and 3.

The work of waving and undercutting the band groove has been concentrated on one single spindle machine, and the balance of the operations left to the other three machines of the battery, as mentioned above.

Unique Tooling

The gang tooling and the interchangeable unit tool blocks used on these machines are particularly interesting points, and are shown in Fig. 3. The three separate tools for finishing base,

rounding corner, and machining groove are shown in place, while on the right of the illustration the block is dismantled, showing separate rocking plates under

FIG. 3. UNIT TOOL BLOCK, ASSEMBLING JIG, AND COMPONENT PARTS.

each tool. These cutting tools are all maintained at standard angles and dimensions, and are kept in the tool room along with the tool-setting jig shown in the illustration. This jig is so constructed as to hold the tool block in the same relation to a dummy shell A (which is part of the jig), as it will bear to the work on the lathe. Spare blocks with the tools already set up are kept in the tool room ready for the lathe hands.

The fixture used for cutting the dovetail in the band groove is rather unusual. It is shown in Fig. 4, from which it will be noted that both tools work from the same side and operate simultaneously. The shape of the tool holders is such that straight bars of square ready-hardened high-speed steel can be used, being ground only on the front end. The cutting edges are well supported, and the tools cheap and of such size that they readily conduct the heat away from the cut. It is, therefore, possible to work dry.

There is nothing very unusual about the boring operation except that it is split betwen two machines. The roughing is done on a 25-in. "Gisholt" big bore turret lathe, and the finishing on a double spindle Jones & Lamson machine, Fig. 5. The shells at this point are ready for the furnace room.

Coal Fired Furnace

The heat treatment is a particular feature of shrapnel manufacture, and the principles involved have been frequently discussed. As mentioned above, the equipment used is the same practically without alteration as that used for heat-treating and case-hardening

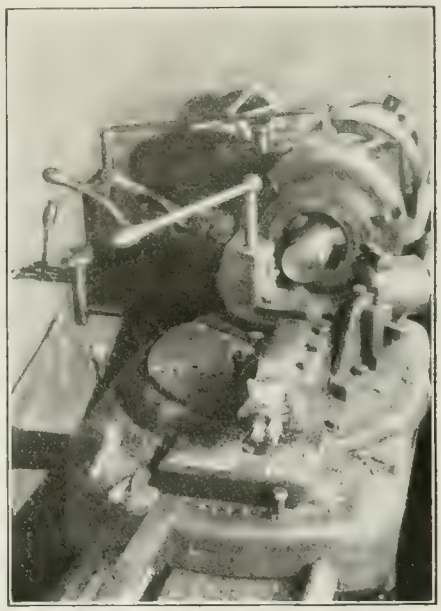


FIG. 4. UNDERCUTTING BAND GROOVE ON J. AND L. FLAT TURRET LATHE.

gears. In heating the shells for hardening, a large Brown & Sharpe oven furnace is used, and the fact that anthracite is the fuel renders this operation worthy of note. This is especially so in view of there being no scaling from the exposure to the direct heat of the fire. There are reasons for this.

First, the heavy bed of incandescent fuel, with only a moderate blast, maintains a reducing atmosphere in the furnace. Second, the base and band groove of the shell are painted before insertion in the furnace with a mixture of boracic acid and animal charcoal (bone black), mixed to a creamy consistency with quenching oil. Any slight amount of oxygen in the furnace would, therefore, have to consume the carbon before attacking the steel, and the boracic acid makes the cleaning of the surface with a rotary wire brush quite easy. No sand blast is used.

The shells are quenched at a suitable temperature in a tank of soluble quenching oil, a copious stream of oil being introduced inside the shell at the same time. Subsequent tempering to a suitable scleroscope reading brings the strength of the shell to the desired degree. The only subsequent cleaning required consists in washing in boiling soda water, rinsing off in clean water, and brushing with an "Economy" wire brush on buffing stand.

In the next operation, the nose of the shell is heated in a lead pot (gas fired) for about two inches, and crimped to shape in a hydraulic press. The shell is then reheated in the same furnace to relieve strains in the steel and afterwards placed muzzle downwards in a tray of ground mica to anneal.

The succeeding operation is done on two single spindle flat turret lathes, Fig. 6. This operation consists in trimming the shell to exact length, boring the nose, forming the inside curve, tapping the nose with a "Geometric" collapsible tap, and rough forming the outside curve of the nose. Both inside and outside curves are formed with flat cutters, brought into operation by cross traversing the head of the machine. All the operations on flat turret lathes are controlled by stops, both for length and diameter movements.

Noiseless Grinding

Finishing of the parallel portion of the body on a "Ford-Smith" grinder constitutes the next operation. The nose profile is not ground. The holding arrangement used on this machine is somewhat different from that in other shops, in that the shell is mounted on centres, using a cup over the base, and is driven by gripping the nose end on the rough shell about where the shoulder is to be finished. (See Fig. 7.) This method of driving relieves the chuck of all strain due to the pressure of the grinding wheel. The live centre offers a much firmer support for the shell, and conveys

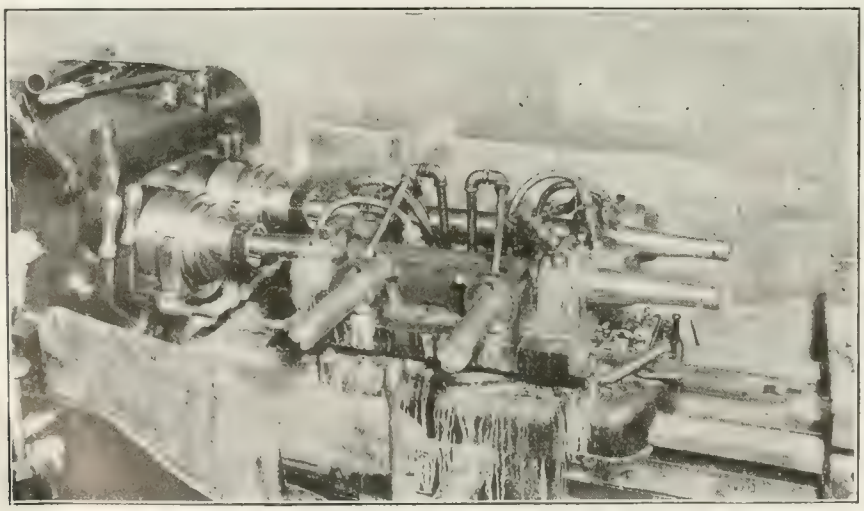


FIG. 5. BORING EQUIPMENT ON DOUBLE SPINDLE J. AND L. FLAT TURRET LATHE.

the grinding vibration directly into the frame of the machine, where it is absorbed. The reduction of noise due to this arrangement is remarkable, the shrill whistle, which is so objectionable when using a chuck, being almost eliminated.

The shells are then passed on, with the plug centres still screwed into the shell be adjusted in the chuck, which takes time, and is not so easily controlled as the method described.

Unusual Profile Attachment

In the present case the shell is chucked without any unusual care, and the tailstock centre brought up to position. This is done by sliding the tailstock a

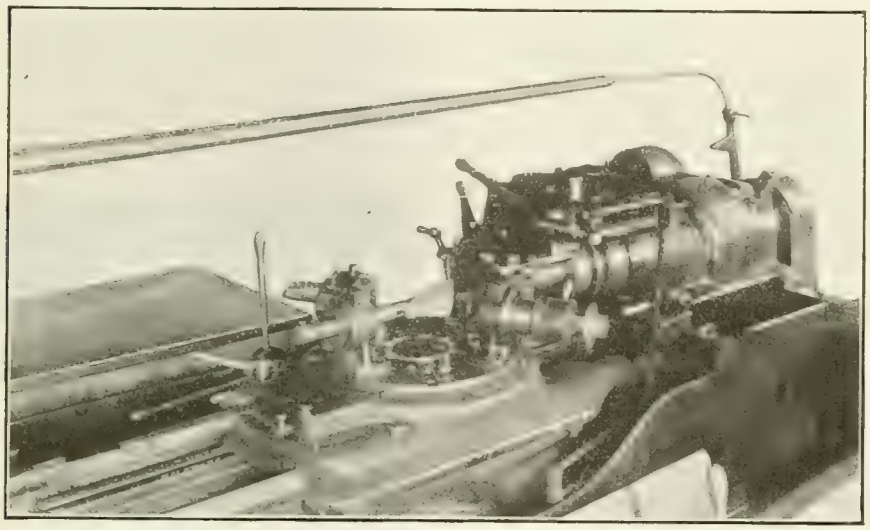


FIG. 6. MACHINING AND THREADING NOSE OF 18-PR. SHRAPNEL SHELL.

muzzle end, to the engine lathes (two in number), which finish the balance of the profile.

The profiling attachment used varies somewhat from the usual arrangement. The templet, Fig. 8, is mounted on a rigid bar, which is securely fastened to the tailstock instead of the headstock, as in some cases, or the lathe bed in others. The adoption of this principle overcomes the necessity for locating the shell accurately in the chuck in relation to the templet, and also enables full advantage to be taken of the allowable variation in the overall length of the shell, so that when a shell comes through which is a little long, it is not necessary to re-

trifle nearer the shell than necessary. The shell, previously trimmed to size on the end, and being now fitted with a centre plug, the machined surface on the end of the shell is used as a point from which to gauge the position of the tailstock, a suitably prepared point on the end of the tailstock casting being used. As the profile copy is rigidly fastened to the tailstock casting, its position in relation to the nose of the shell is determined accurately and individually for each shell.

After a thorough cleaning, the shells are carefully gone over by a shop inspector and submitted to the Government inspectors for the preliminary inspection of the completed steel shell

ward motions. By this means a great saving is effected in the handling and in storage space. The first operation in the loading room is the pressing on of the copper driving bands, which is performed in the conventional manner, using a six-cylinder hydraulic press of the tire-setting type. From this machine the bands pass to a 3-in. x 36-in. Jones & Lamson flat turret lathe, where the bands are turned. Two forming tools, a roughing and finishing, are used, the former feeding radially and the latter being drawn through under the work in a direction tangent to the surface.

Assembling

The copper band inspector picks up the work from the tray on the rear of the lathe and, after examining the band, lays the shell on the assembling bench close by the man who puts in the tin powder cup and brass firing tube. This cuts out two handlings. The shell is then filled with lead bullets and the total weight checked. The remaining space is then filled with melted rosin, which, on cooling, acts as a matrix and prevents any loosening of the internal parts under the shock of being fired from the gun. An additional object of the rosin is to generate a cloud of smoke when the shell is exploded so that the accuracy of aim and range may be observed and controlled by noting the smoke clouds.

The weight of the shell, including the rosin, is again accurately checked, and the brass socket is screwed home in the threaded nose. The end of the firing tube projects through the central hole in the socket and the joint between these two is now securely soldered. An electric soldering bolt with hollow point is used for this operation. The shell is now ready for the last machine operation.

A Simple Lathe

The outside form of the socket is turned and the excess solder removed from the inside in a special lathe built

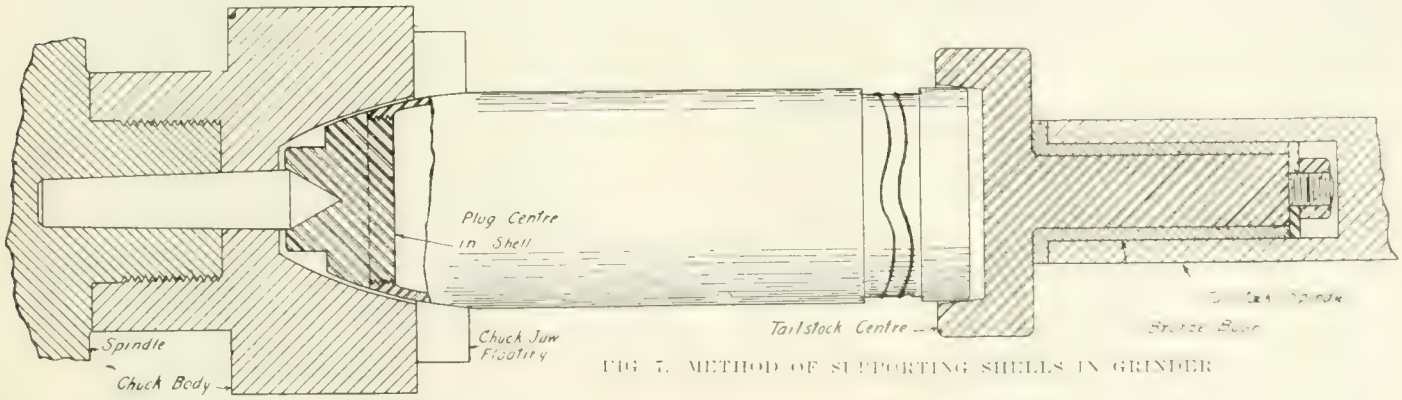


FIG. 7. METHOD OF SUPPORTING SHELLS IN GRINDER

move any more metal than is necessary to come below the high limit; whereas when the profile copy is fixed rigidly to headstock or lathe bed, the tool will cut to the same point every time, unless the

case. On leaving the Government inspection room, the shells travel in a circular path from one machine or bench position to another around three sides of the loading room without any halt or back-

by the Hamilton Gear and Machine Co. for the purpose. It is purely a single operation machine, being a lathe reduced to its lowest terms. It consists of a heavy spindle mounted in two generous

ring-oiling bearings and driven by tight and loose pulleys and a wide belt. The shell is mounted in a simple chuck of the

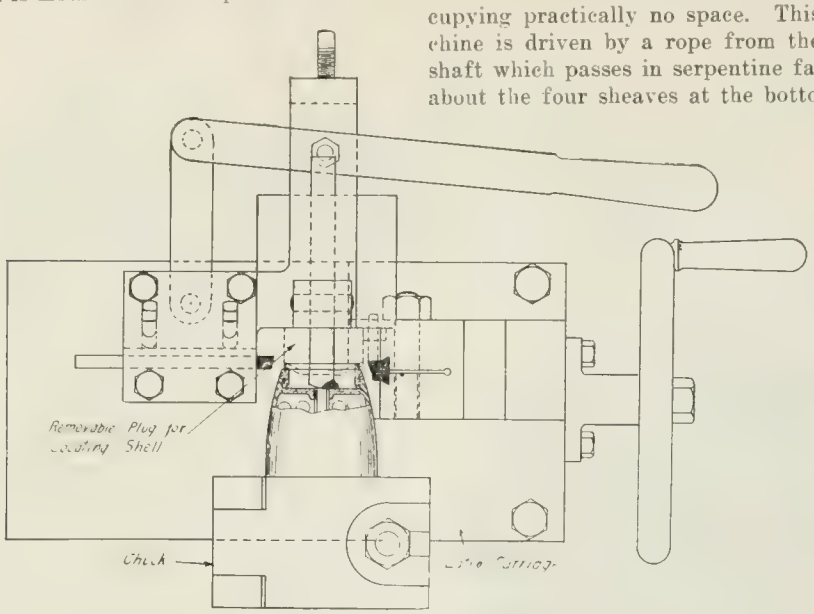


FIG. 9. PLAN OF TOOL CARRIAGE ON SOCKET TURNING LATHE.

hinged type, which grasps it back of the shoulder. Fig. 9 shows a plan of the tool carriage in which three tools are used—front forming tool for the curve of the profile, back forming tool for the recess or check, and a boring or facing tool for trimming the inside of the socket and removing the excess solder. The hand wheel on the cross-feed screw is large, being about 9 in. diameter, and graduated on the rim to read in thousandths of an inch. Easy reading and rapid work are facilitated by the large circle and wide graduations. Of course, simplicity of the tooling is also a factor in the quick production which is obtained with this equipment.

Flat Die Marking Machine

The sockets are next hand-tapped with an expanding adjustable tap, which is kept in accurate agreement with the Government gauges, then passed to an inspector and afterwards to the marking machine. The latter handles the shell in the usual oscillating manner, supporting it on rollers, but differs from the usual type, in having the letters in a flat die holder, which is traversed back and forward under pressure by a rack and gear segment. This form of construction has a number of advantages, chief of which is the cheapness of type and the readiness with which they can be changed when single letters become damaged or worn out.

After marking, the shells are carefully blown out with compressed air and again checked for weight before passing to the Government inspector for the final inspection and marking with the official acceptance stamp.

The last operation is the painting, which is done on a four-spindle machine let into a slot in the bench top and occupying practically no space. This machine is driven by a rope from the line shaft which passes in serpentine fashion about the four sheaves at the bottom of the spindles. After painting, plugs are screwed into the sockets to protect them from damage in shipping, and the shells are packed in the regular six-round boxes supplied by the Government.

The main feature of this plant, aside from some very ingenious examples of tooling, is the demonstration of how much can be done with very limited floor space in the way of eliminating storage intervals and handling between operations. The machines are set very close, and at each operation where possible the shifting from one machine to another is done by an inspector, who picks up the work from the previous machine and, after examination, places it ready for the next operator. In many cases he can do this without taking more than one step. On some operations, galvanized iron chutes are used to carry the shells between inspectors' and operators' positions.

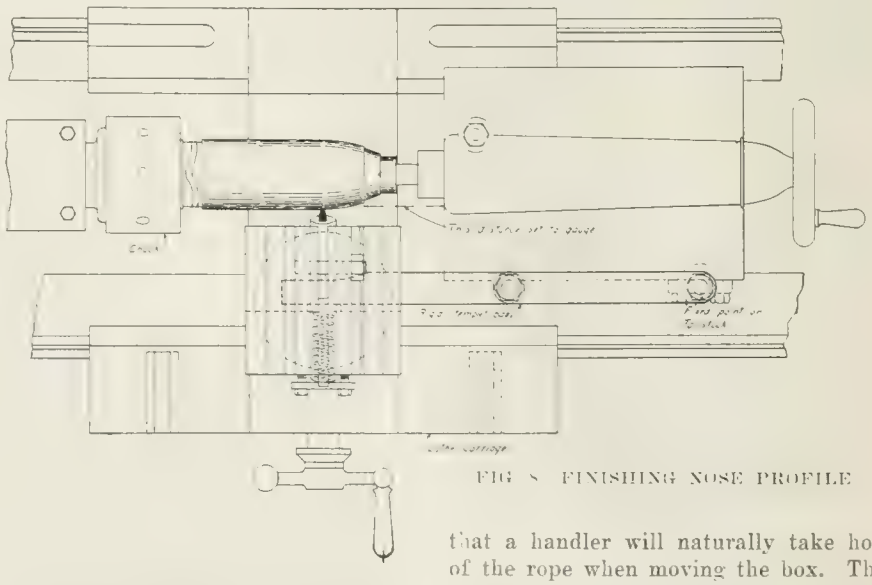
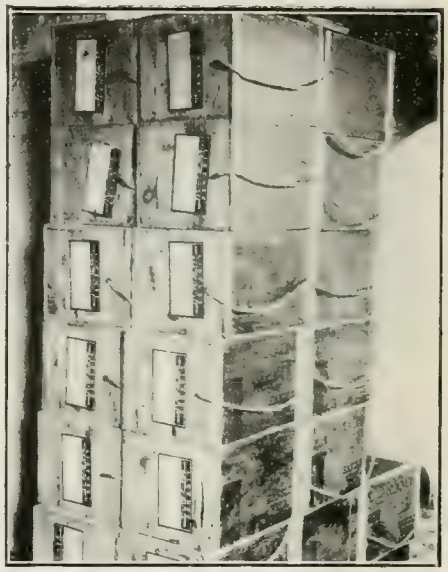


FIG. 8. FINISHING NOSE PROFILE

A SHIPPING KINK.

By A. E. G.

THE Lovell-McConnell Mfg. Co., Newark, N. J., makers of Klaxon automobile signal horns, had considerable difficulty in packing the latter so that the bell of the horn would not be dented in transit. The trouble was principally caused by the handlers dropping the box in which the horn was packed with more or less force, and if the bell of the horn happened to be



A SHIPPING KINK.

downward, the result was almost sure to be a dented or crushed bell.

Someone in the shipping department finally hit on the plan of putting rope handles on all the shipping boxes, so that a handler will naturally take hold of the rope when moving the box. This keeps the boxes top up in almost every instance, and as the horns are packed accordingly, the result has been very satisfactory.

PRODUCTION METHODS AND DEVICES

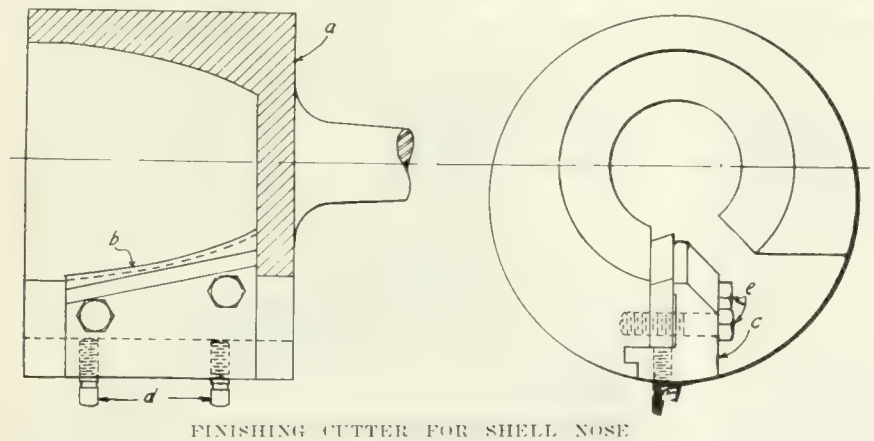
A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

HOLLOW PROFILE MILL FOR SHELL NOSES.

A SIMPLE design of hollow mill with single inserted cutter for finishing the nose profile of 3.3-inch H.E. shells is shown in Fig. 1. The cast iron body (a) is provided with a suitable taper shank to fit drill spindle, and is bored out, as shown, to fit the finished shape of the shell. This hole is concentric with the shank, but the outside diameter of the mill is made considerably eccentric. In the end view it will be observed that this heavy side is partly cut away to allow of the blade (b) being secured in the proper position. Clamping plate (c) is formed with a heel which fits into check shown, and provides suitable support for the adjusting screws (d) which are used in setting the blade (b).

Clamping screws (e) pass through clearance holes in the plate, and into tapped holes in the body (a). Blade (b) has two oval holes with ample clearance, so as to allow of considerable wear on the cutter being taken up without fouling screws (e).

Suitable clearance space for chips, etc., is provided by this design. This tool is used only for the finishing cut or scrape, and enables the desired profile to be obtained easily by means of adjusting screws (d).



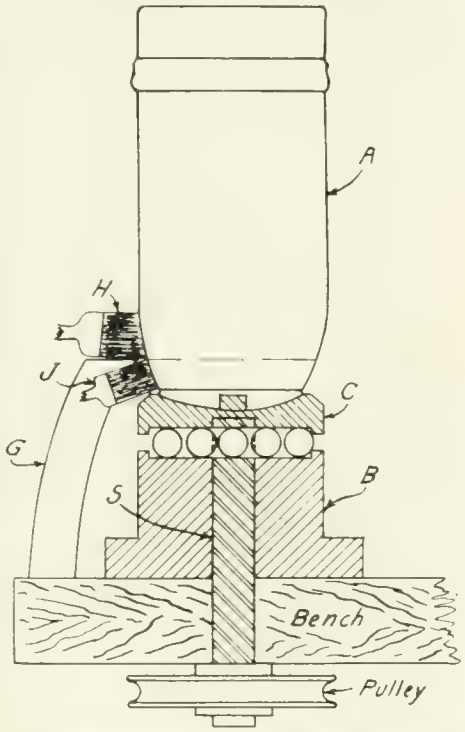
FINISHING CUTTER FOR SHELL NOSE

BALL-BEARING SHELL PAINTING DEVICE

By J. H. R.

SHELL manufacturers throughout the Dominion are employing several different methods for painting shells. The device here shown is used in one of our smaller plants, and while the output is somewhat less than with other painting machines, it meets the requirements of the shop production.

The cast iron base B which is secured to the bench, has a ball-race of suitable size machined on the top. Through the centre of base B a hole is drilled to fit the shaft S, the latter being fastened into the head C which is also made of cast iron. A ball-race of the same dimensions as that in the base is machined on the bottom of C and on the top is formed a cup-shaped recess with a square pin projecting upwards to engage the square hole of the plug in the shell nose. Several balls of a suitable standard size are placed in the ball-race, and the head C is placed in the position as shown in the drawing. The operation is as follows:



BALL-BEARING PAINTING DEVICE

The shell is placed in the head C, the latter being revolved slowly by means of a small grooved pulley placed on the shaft S, beneath the bench. In painting, the brush H is held against the revolving shell and is moved along the body as far as the limit set by the gauge G. This gauge is of the correct height and is fastened to the bench. Above this gauge the shell is painted dull grey and below by means of the smaller brush, J, the nose of the shell is colored red also to the required distance.

SUGGESTION FOR CUTTING SPIRALS.

By G. Miller.

THE following rule or idea may not be new; in fact, may be known to a large number of mechanics, for, as a certain wise man once said, "there is nothing new under the sun," yet as the writer has never seen it mentioned in any mechanical paper, and as it may be of assistance to some worried mechanic and help him out of a "hole" some time, its uses and advantages are here set forth.

The printed tables accompanying universal milling machines do not give all possible combinations of gears for cutting spirals, and to "figure out" the right gears to cut a special spiral for which the printed table does not make provision, requires, in some cases, a considerable amount of mathematical knowledge. Suppose we wish to cut a groove in a one inch piece—a one inch twist drill blank for example,—so that this groove makes one complete turn around the piece in a length of six inches. If we were able to unroll this piece into a flat surface, we would have a rectangular piece of 6in. long by 3. 1416 in. wide with a groove diagonally across its face from one corner to the other as shown by Fig. 1, or if we wish to cut a spiral 1 in. in diameter, the groove to have one complete turn in 3 in., its unrolled surface would be represented by a rectangle 3 in. by 3. 1416 in. with a groove diagonally across its face from corner to corner as shown by Fig. 2.

From this it can be easily seen that to cut any spiral it is only necessary to know the diameter of the piece and the lead of the spiral, that is the length of piece required for the groove to make one complete circle around it. From these dimensions a rectangle can be easily drawn. The difference in the length of the base line and the upright line is the ratio between the turning gears and the feeding gears. If the

piece to be cut has a circumference of 4 in. and the groove is to make one complete turn in 2 in. this would be represented by an angle with a base line of 4 in. and an upright line of 2 in., which would show that the revolution of the piece to be machined would be double the speed of the feed of the machine, the base line in all cases representing the revolution of the blank and the upright line representing the feed.

The writer is reminded in this connection of a certain case where some thousands of spirals were to be cut in a cer-

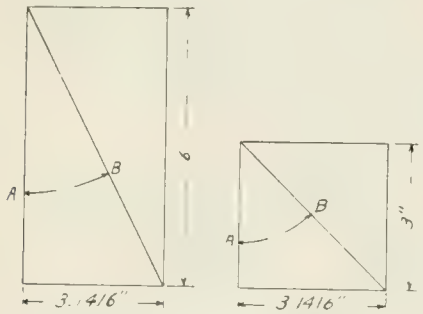


FIG. 1 FIG. 2

tain shop on one of the best makes of American milling machines. In this particular instance the printed rules accompanying the milling machine had to be cast aside as utterly useless and the rule herein given was successfully applied. There is another application of this rule that the writer has found useful.

It may not be generally known that the printed tables accompanying universal milling machines do not always and in all cases give the correct number of degrees and minutes to set over the table when cutting spirals. This statement will probably be discredited by some people, especially makers of milling machines, but the writer knows it to be true, not only by years of observation, but by actual experience.

All mechanics when cutting spirals know that if the "set over" of the table of a milling machine is not parallel with the proposed groove in the blank, the cutter will "drag" more or less on one side or the other, and raise a burr that is detrimental to good work. The writer has seen burrs raised on spirals by a too faithful adherence to the printed tables that would set one's teeth on edge, mechanically speaking. By use of the rule given in the first part of this article and a very slight knowledge of trigonometry, the correct position for the milling machine table can be quickly found. All that is necessary being to know what angle it is from A to B, Fig. 1 or 2, the unrolled diagram of the proposed spiral being the correct angle to set over the table. By making a very careful diagram of the angle and using a good bevel protractor a very close approximation to correct measurements can be found. It may be objected that it is not necessary to go to all this trouble as the correct angle for the table may be found by marking across the blank with the milling cutter and then using a straight edge, but this method can be used only with spirals of very little lead, and only in some cases, and can never be used with any assurance of success when cutting spiral gears with larger lead.

OIL-GROOVING ON A PLANER

By A. E. Granville.

MANY firms building machine tools still chisel out the oil grooves in their machine beds and tables by hand, using a round-nosed gouging chisel. This is a slow process and, as a rule, looks amateurish, except on machines that are too large to have the work done in any other way. The oil-grooving of gibs or other small pieces by hand, however, has little excuse where the parts are used in any reasonable quantity, as there are numerous ways of doing the work quickly and cheaply on a planer.

A planer rigged up for grooving gibs is shown in Fig. 1. Here the gib is placed in a holder, which is bolted to the planer table. The gib is butted against one end of the holder, and is held in place by two set screws and clamping pieces A and B. The oil groove cut is plainly shown at C. In placing the attachment on the planer, the cross-fed screw is loosened so that the saddle will move freely on the cross-rail. The bracket D is then clamped to the rail as shown. This bracket carries the bell-

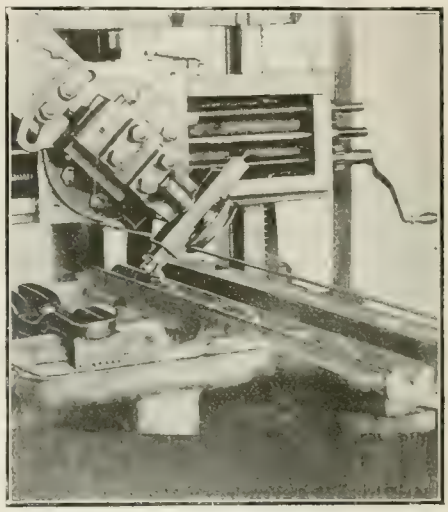


FIG. 3 HEAD SET FOR BEVEL WORK.

crank E, which is connected to the saddle by the link F, while a connecting rod G connects the other arm of the bell-crank to the crank disc H.

A ball-and-socket joint is used at each end of the rod G in order to allow for the movement as the mechanism operates. The crank-disc is geared to the main driving shaft, so that the saddle is given a rather slow reciprocating movement, as the planer table travels beneath it. The amount of stroke can be varied considerably by adjusting the end of the rod G in the slot of the crank-disc, and also by sliding the bell-crank up or down in the slot of the bracket. The gearing may also be changed when needed. When

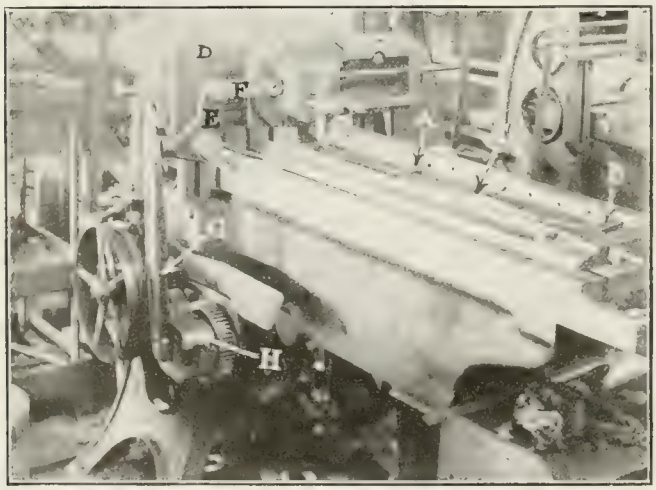


FIG. 1 ATTACHMENT FOR GROOVING GIBS

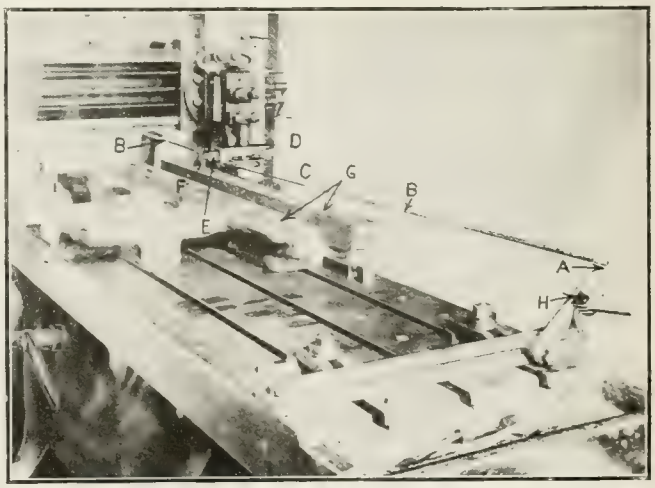


FIG. 2. ATTACHMENT FOR GROOVING FLATS OR BEVELS.

not in use, the whole apparatus may be detached and the planer employed as usual.

Another somewhat simpler device is shown in Fig. 2. An arm A is fastened to the planer table, as shown. A piece of window cord is run from this arm, wrapped once around the grooved pulley C, and then fastened to another arm at the back. The hub of the grooved pulley is turned eccentric at D, so that as it turns the slide E, carrying the tool F, is given a reciprocating motion. Now it will be plain to the reader that as the planer table travels back and forth the cord will cause the pulley to revolve, and when properly set, the tool will cut oil grooves, as shown at G. This device has the merit, that while not as workman-like as the first described, it is easily made, and can be placed on any planer without altering the mechanism in any way.

When grooving V's the head is tilted, as shown in Fig. 3, but otherwise the parts are left as for flat work. This is an advantage not possessed by the other device.

FUSIBLE PLUGS FOR BOILERS.

AN investigation of fusible tin boiler plugs, just completed for the Bureau of Standards by Dr. G. K. Burgess and P. D. Merica, will probably result, says the Iron Age, in the substitution of a new series of specifications for those heretofore employed by the Steamboat Inspection Service, the American Society of Mechanical Engineers and the Interstate Commerce Commission. The results of the investigation indicate that through the lack of technical knowledge on the part of manufacturers and users of the behavior of tin plugs containing relatively small percentages of impurities this safety device has been rendered practically valueless in the average boiler. By the use of simple precautions suggested by the Bureau's experts, it will be entirely practicable to produce plugs that may be relied upon to fulfill their functions under all conditions.

Fusible Plugs and Their Function.

The fusible boiler plug in its usual form consists of a brass or bronze casing with external pipe thread, filled from end to end with a fusible metal or metal composition which has a melting point around 480 deg. F. These plugs are fitted at various places into the boiler, in the flues, tubes or combustion chamber, in such a position that they are about 1 in. or more above the dangerous low water level, with one end on the fire and one end on the water side. As long as the water level in the boiler is above these plugs, the temperature of the latter remains below the melting point of the filling, but if the water falls much below the level of the plug, opportunity is given for local overheating and the filling of the plug then melts and is blown out.

Tin of Plug Changed to Tin Oxide.

Tin seems to be the metal used at present almost exclusively as the fusible constituent of such plugs and is required by all standard specifications. It would seem to be in this respect a desirable metal, having a low melting point, being only slightly corrodible and easily obtained pure. Its desirability in this respect is nevertheless to some extent called in question by the results of the investigation which has just been completed by the Bureau of Standards. This inquiry was undertaken to determine why certain plugs have been found intact in boilers which have exploded as the result of low water and consequent overheating of the boiler plates.

Heavy loss of life occurred as a result of one of these explosions. The plug in this case was sawed open longitudinally and was found to contain traces only of the original tin, imbedded in a dirty, greenish matrix, which was ascertained to be largely tin oxide, and which upon test showed a melting point about 2,900 deg. F. This oxide was distributed in such a form and quantity that it held the pressure of the boiler and would not have melted until the bronze of the casing and even the steel of the boiler had melted. It is obvious from this examination that when reliance is placed upon such a plug to give warning of dangerous boiler conditions it is looked upon as an actual source of danger instead of safety.

Plugs of Faulty Manufacture.

The question thereupon arose as to the source of the tin oxide, as to whether it was there originally, or had been formed by corrosion, and if so, is the cause for its comparatively rare occurrence in such plugs to be sought wholly in the different operating conditions of the boilers, or is it a fault in the method of manufacture?

A request was made of the Steamboat Inspection Service that more plugs be sent in to the Bureau for test, including both new plugs and those which had been removed by inspectors. About 1,050 plugs were subsequently received, of which about a hundred had been in service varying from 4 to 12 months. The entire collection represented the products of 105 firms of manufacturers. After these plugs were tested for dimensions, they were sawed open axially through the centre, and the form and condition of filling observed. Particular attention was paid to the presence of oxide, scoriae, blow holes and other faults originating either in the manufacture of the plugs or during their service.

The Bureau's investigation demonstrated that the correct design of a fusible plug is of more importance than might be supposed. Owing to the difference in the coefficients of expansion of the casing and of the filling of such a plug and to the existence of an allotropic change in tin at 320 deg. F., there will be interplay between casing and filling unless the design is such as to support the filling rigidly in the casing and the adhesion between the two is excellent. A smooth bore "tapering evenly from end to end" is, therefore, not to be recommended, and it is noted that the Steamboat Inspection Service has recently allowed a fine inside thread. In the opinion of the Bureau's experts, however, there is no reason why a thread should be allowed and not other types of recess or projecting shoulder to keep the tin filling rigidly in place.

As a result of the examination of the sample plugs and an investigation of the reported failures and of certain tests made at the Bureau, it appears that the failures of tin plugs are of two types; first, those in which the oxide forms as an interlocking "network" throughout the tin of the filling and, second, those in which the oxide forms as a solid, hard mass at the fire end of the plug. An explanation of the formation of the network was found in the presence of zinc in amounts varying from 0.3 to 4.0 per cent. The experts also reached the conclusion that plugs containing zinc in quantities mentioned were apparently in good condition when inserted, but subsequently underwent a progressive change, becoming no longer fusible in the sense that they would melt below a temperature sufficient to fuse the steel plates of the boiler.

Zinc Should Not be Used With the Tin.

"The fact that stands out most strongly throughout this investigation," says the report in conclusion, "is that zinc should not be present in the tin fillings of fusible plugs. The lowest zinc content actually found in any of the plugs analyzed, which displayed the network type of oxidation, was 0.3 per cent., but this cannot be accepted as the actual lowest value of the zinc content at which oxidation can take place. Furthermore, although zinc is, because of its greater corrodibility, most dangerous when coalesced into a network of structure such as is developed upon heating to about 180 deg. C., other metals which do not form solid solution with tin may also cause the formation of this structure, as, for instance, lead.

It seems then that in such plugs tin must be used which is as free as possible from zinc and lead. This statement is made notwithstanding the apparent fact that if zinc is present a small content of lead is actually beneficial. It is better to prevent this oxidation by using pure tin than by using lead with tin containing zinc."

Principles of Laying-Off Cylindrical Intersections--V.

By J. W. Ross

The more or less special nature of the work involved in the making of sheet metal piping has caused many manufacturers to avoid this class of work, with the result that when a job has to be handled, there is frequently considerable unnecessary loss incurred through errors in laying off material. The examples treated by the writer of this article should form a valuable reference to many manufacturers on ordinary as well as special occasions.

RECTANGLE INTERSECTING A CYLINDER.

THE same principles are adopted in this or similar problems as was adopted in the preceding problems of intersections. Fig. 38 shows the perspective, Figs. 39 and 40 the elevation views. Enough information can be obtained from the drawings without any explanation. Develop the patterns, Figs. 41 and 42, in precisely

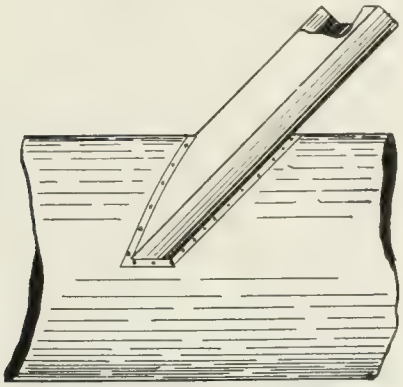


FIG. 38.

the same manner as the problem shown in Figs. 34 and 35.

Connecting Pipe Between Two Circular Tanks.

The perspective view, Fig. 43, and the elevation, Figs. 44 and 45, show a connecting pipe between two circular tanks. This problem deals with heavy plate. The patterns are developed in accordance with the instructions given on heavy plate in development of the problem shown by the Figs. 18 and 19.

Y or Three-way Pipe.

The intersection of three pipes forming a Y is shown in the perspective drawing, Fig. 49, and the elevation view, Fig. 50.

Construction.

Draw the horizontal line, 7° 1°, Fig.

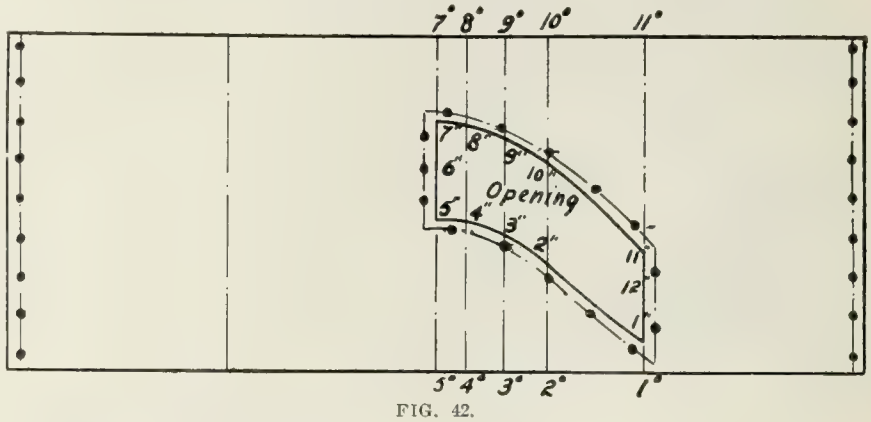


FIG. 42.

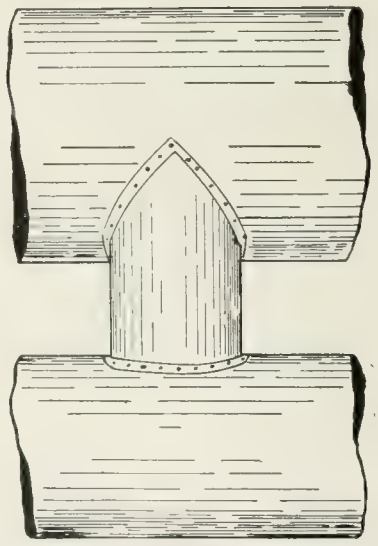


FIG. 43.

50, equal to 1 inch. Bisect at 4° and erect the perpendicular 4° 7^1. Locate the point 4^x, 7/8 in. from 4°. At an angle of 45 degrees to the horizontal

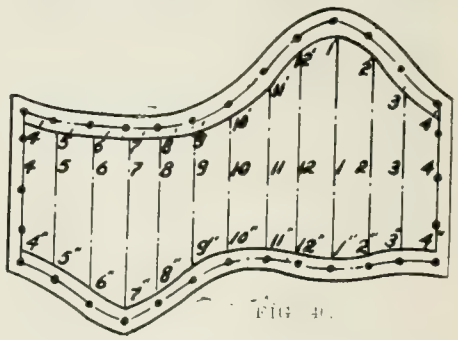


FIG. 49.

line draw the inclined line 4^x 10. Also line 4^x 4, each equal to $1\frac{5}{8}$ inches. At right angles draw the line 7 4 1 equal to 7° 4° 1°. Draw the line 7 7^1 parallel to 4^x 10—to the intersection of the vertical

[1]Note: The reference letters and numerals in the text, i.e., G^2, 7^2, etc., correspond with those of the illustrations indicated as G^n, 7^n, etc.

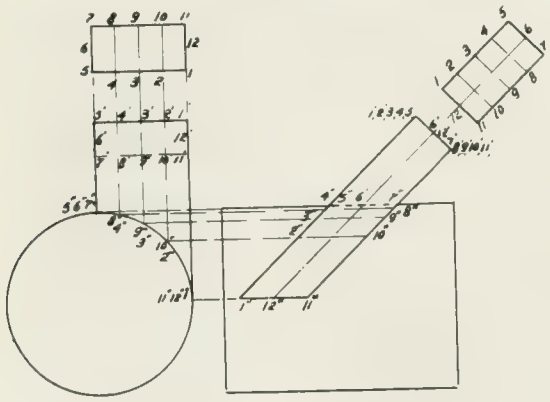


FIG. 39

FIG. 40.

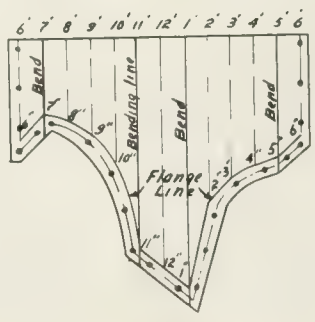


FIG. 41.

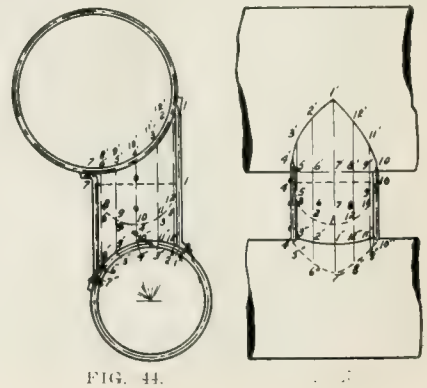


FIG. 44.

line 4° 7¹. Also parallel to 4ˣ 10 draw the line 1 1ˣ to the intersection of the vertical line 1° 1ˣ. Connect 4ˣ to 1ˣ. Construct the left-hand side of Fig. 50 in a similar manner. Then 7² 4ˣ 1ˣ defines the

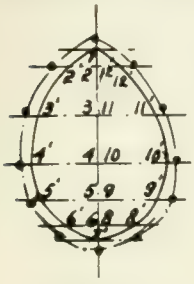


FIG. 47.

FIG. 48.

mitre line for the lower course, and 1ˣ 4ˣ 7¹ for the inclined course. With O as centre describe the plan view, 1 4 7 10. Divide into 12 equal spaces. Project these points to the mitre line, 7² 4ˣ 1ˣ. Again, with X as centre describe the plan view of the inclined pipe as shown by the circle 1 4 7 10. Divide into 12 equal spaces. Project these points —parallel to 10 4ˣ—to the mitre line

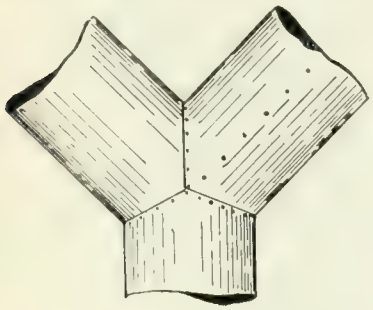


FIG. 49.

7¹ 4ˣ 1ˣ. Draw the stretchout 1° 1¹, Fig. 52. Divide into 12 equal spaces. Transfer the measurements 1° 1ˣ, 2° 2ˣ, 3° 3ˣ, etc., Fig. 50, to their similar lines in Fig. 52. Draw a curve to define the mitre or flange line; add the laps. Space in the rivet holes. Similarly transfer all the

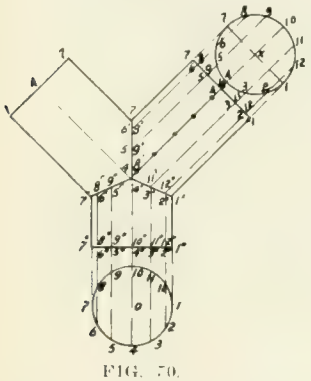


FIG. 50.

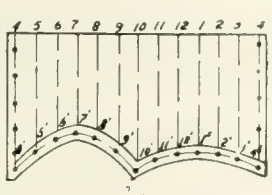


FIG. 51.

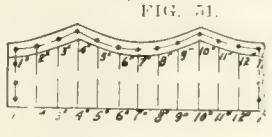


FIG. 52.

element lengths of the inclined cylinder to their respective points on the calculated stretchout, Fig. 51. Fig. 51 will be the templet for both the inclined cylinders. The preceding problems cover fairly well the various intersections developed by parallel lines. In the next article conic intersections will be dealt with, showing the radial method.

GRINDING AS A MANUFACTURING PROCESS.

By Howard W. Dunbar.

GRINDING for manufacturing operations, as distinguished from grinding simply for accuracy, such as tool room grinding, requires that the work in hand be given intelligent thought by the manufacturer. The grinding machine, alone, without the aid or intelligence of the engineer, superintendent and manager, can never be successful.

It is not the intention of the grinding machine manufacturer of to-day to deprecate the value of the lathe, milling machine, planer or any of the other more commonly known forms of machine tools, but rather, owing to the presence of the modern grinding machine, the value of these other forms of machine tools is enhanced; the only change in the conditions to-day being that the modern grinding machine calls for a greater effort on the part of the makers of lathes, milling machines, planers, etc., to make good, heavy, well-built machines with which to assist the grinding machine in the production of work more quickly and economically. A great many of the differences of opinion are purely psychological, and because tradition has said, do so and so.

Importance of Turning.

In the manufacture and use of the grinding machine the question of turning is of the greatest importance, and in turning is the greatest of all savings, when we have the modern grinding machine to grind accurately to size and with good finish. Here is made possible the cheapening of the turning operation, but to do this we must have good, heavy lathes, capable of performing the work in the manner best suited for the grinding machine operations. As a rule, most machine tool users do not consider this.

The proper relation of turning to grinding (and by this is meant the way and manner in which the operation is performed, the amount of stock removed by the lathe, the amount of stock removed in the grinding machine, the number and depth of the cuts, etc.) can only be determined after scientific investigation of each piece to be finished. No rule can be laid down whereby it becomes an established fact. Sometimes it is most profitable to grind without turning at all; more times it is not. The statement of this fact generally starts every one to grinding from the rough, whereas each piece should be studied, and the proper operations applied, if you wish to determine the cheapest way of producing your parts.

Economical Production of Cylindrical Work.

This brings us to one of the points for consideration—the most economical method of producing cylindrical work. To start with, let us make a radical departure from the now common form of organization in most all machine shops. It is our firm belief that the turning department and the grinding department should come under the same foremanship, as the finished part requiring grinding is only produced at least cost when the proper relationship of the turning operation to the grinding operation has been determined. So, by placing the responsibility of the final cost with one man we are working towards the end which must result in the most economical production of round work.

The grinding machine to be successful requires that all tradition be thrown to the winds. To illustrate: Tradition tells a lathe operator that he will save time in turning by taking one cut, and that a deep one, if his lathe is powerful enough. Investigation of the proper use of the grinding machine shows that in many cases the work can be produced for less cost if two or even three cuts are taken in the lathe, for the reason that sometimes the work is too frail to stand the rapid traverse feed with one deep cut. In such cases two cuts, even three, will sometimes prepare the piece properly for the grinding machine in less time than the single cut with slower traverse feed.

Again—tradition tells the lathe operator that if he turns his work very close to size it will require less time for grinding. This is true, but it may not be true that the work will cost less thereby.

In the case of long, frail work like countershafts, etc., tradition tells us they must first be turned and then ground, and it is true that in producing such a piece, 1-16 in. in diameter can be removed in less time in the lathe than it can be done in the grinding machine, but it is not true in all cases that it will cost less, for the reason that when such pieces are turned rapidly with one single cut in the lathe, although only 1-16 in. is removed, they must be straightened before they can be ground.

We have in mind a piece of work that required six minutes for turning the roughing cut and nine minutes for grinding the roughing cut, but the straightening of this work after turning required nine minutes. So in this

case the turning was literally thrown away. These pieces were afterwards rough ground, taking off the 1-16 in. in nine minutes, requiring no straightening after the rough grinding operation and the workman then had simply to finish grind in the usual manner.

It must not be understood that we recommend grinding without turning in all cases; we do not. The reverse is usually true, but it is also true that thousands of dollars are thrown away every year because shops follow tradition and turn everything before grinding and thousands more are lost because shops following tradition, turn work too nicely and too expensively and too close to size.—Grits and Grinds.

COAL-TAR PRODUCTS USED IN MAKING EXPLOSIVES

By C. G. Storm.

MONONITROBENZENE, commonly known as "oil of mirbane," is little used in the explosives industry because of its volatility, although it is sometimes used as a minor constituent of certain low-freezing dynamites and other types of explosives. It is used much more extensively in soaps, lubricating greases, etc., mainly for the purpose of imparting a more or less agreeable odour. Furthermore, it forms an intermediate product in the preparation of aniline and its many derivatives.

Among the aniline derivatives of importance are tetranitroaniline and tetranitromethylaniline, both of which have in the past few years assumed prominence as detonating explosives for projectiles, mines, and torpedoes. Many other derivatives of aniline have been found to be applicable as stabilizers or as gelatinizing agents in nitrocellulose smokeless powders. Among such substances are methyl or ethyl phenyl urea, phenyl benzyl ether, phenylacetanilide, formanilide, and diphenylamine. The latter is, however, the only one which has been used in this country. The nitrotoluenes are more extensively used in the explosives industry than any other nitrosubstitution compounds, being employed chiefly for sensitizing certain types of ammonium-nitrate explosives and for lowering the freezing point of the low-freezing dynamites.

In the absence of exact statistics, a rough estimate places the amount of the various grades of nitrotoluenes used in the low-freezing dynamites manufactured in this country in 1913 at about 2,000,000 lb., while in the "permissible" explosives employed in coal mining probably 250,000 lb. of the same materials were used during the same year.

Pure crystalline trinitrotoluene has proved one of the most efficient explosives for use in explosive shells, torpedoes, and mines, and is extensively used by almost every important military service, including that of this country. In recent years it has also come into use as a substitute for a large proportion of the mercury fulminate in detonators (blasting caps) and as a charge for detonating fuse.

The nitronaphthalenes are used to some extent, chiefly as sensitizers, in the "short-flame" permissible explosives of the ammonium-nitrate type. Certain derivatives of these compounds, the alkaline salts of nitronaphthalene sulphonic acids, produce, when mixed with sodium nitrate and other ingredients, explosives suitable for coal mining.

Picric acid (trinitrophenol) and certain of the picrates are highly important as military shell explosives; the acid is also employed in surgical dressings for burns and wounds. The manufacture of these compounds depends entirely on phenol (carbolic acid) as a raw material.

The possibilities of the use of the nitroderivatives of coal-tar products in explosives are far greater than is indicated by the above brief summary. Much investigative work on such compounds is being carried on in this country as well as abroad, from which important developments in the explosives art may result. The Bureau of Mines has instituted a systematic research into the preparations and properties of these nitrosubstitution compounds with a view to studying their possibilities in the explosives industry. — From Technical Paper 89, the Department of Interior, U.S. Bureau of Mines.

GERMANS TRY TO GET SHEFFIELD STEEL

IT is reported that the Sheffield Chamber of Commerce has recently investigated some ingenious attempts to obtain high-speed steel and high-class tool steel from Sheffield manufacturers for the use of alien enemies. These special tool steels are necessary in all shops making munitions of war, and as Germany in peace time imported considerable quantities from Sheffield it is probable that she is feeling the necessity of new supplies. The attempts to place orders have been made with great circumspection and it was only the special knowledge of the president of the Sheffield Chamber that brought about the exposure in one case. The Chamber has issued a notice to manufacturers warning them that all inquiries should be carefully scrutinized "in view of attempts now being made to secure high-speed and high-class tool steels for the use of alien enemies. Manufacturers are asked to exercise the same caution even where orders are offered by London agents.

CUSTOMS RECEIPTS SATISFACTORY

CUSTOMS receipts for the month of August, according to official figures issued by the Department of Customs, Ottawa, amounted to $8,330,604.04. This total is very slightly under that of August, 1914-15, when the receipts showed the result of heavy ex-warehousing of bonded liquors in anticipation of the tariff increase. Very large quantities of imported liquors, it will be remembered, were taken out of bond in an effort to escape the heavier duties which, it was expected, would be imposed in the Finance Minister's war budget. Even with this abnormal collection of duty on liquors, the receipts for August last year exceeded those of last month by only $53,202.50.

The statement for this year is accordingly regarded by officials of the Customs Department as in every way satisfactory. The same is true of the statement for the five months of the fiscal year, as compared with ante-bellum months of last year, and making the same allowance for the ex-warehousing which took place in August. The receipts for the five months of the present fiscal year amounted to $36,731,165.01, as against $37,125,639.92 for the corresponding period of 1914-15.

LACHINE CANAL TRAFFIC.

DURING the month of August just closed, the amount of grain brought through the Lachine Canal was 4,651,079 bushels less than what came through in August, 1914. Returns made public yesterday afternoon by the canal authorities indicate a falling off in practically every line of activity connected with the waterway. Coal shipments decreased by 36,661 tons, while not a single sack of flour came down the canal last month, as compared with 102,972 recorded twelve months ago.

Tonnage Lower

There were 1,116 trips through the canal last month, fewer by 347 than last year. The tonnage operated was 589,317 as against 780,352 tons in 1914. The passengers carried through the canal and down the Rapids were 20,453, or 8,206 less than in August, 1914. This last total showed an improvement, however, over the previous month. The cargo tonnage last month was 470,930, a decrease of 190,382. The number of trips light in August, 1915, was 369, as compared with 515 in August, 1914.

For the whole season to August 31 the total grain coming through the canal has amounted to 25,008,924 bushels, just 17,222,206 bushels less than for the same period in 1914.

The propeller efficiency of aeroplanes in practice is about 60 per cent.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

BAND TURNING LATHE FOR 4.5 H.E. SHELLS

THE Jenckes Machine Co., Sherbrooke, Que., have placed on the market a new band turning lathe for 4.5 high explosive shells, particulars and illustration of which are as follows:—

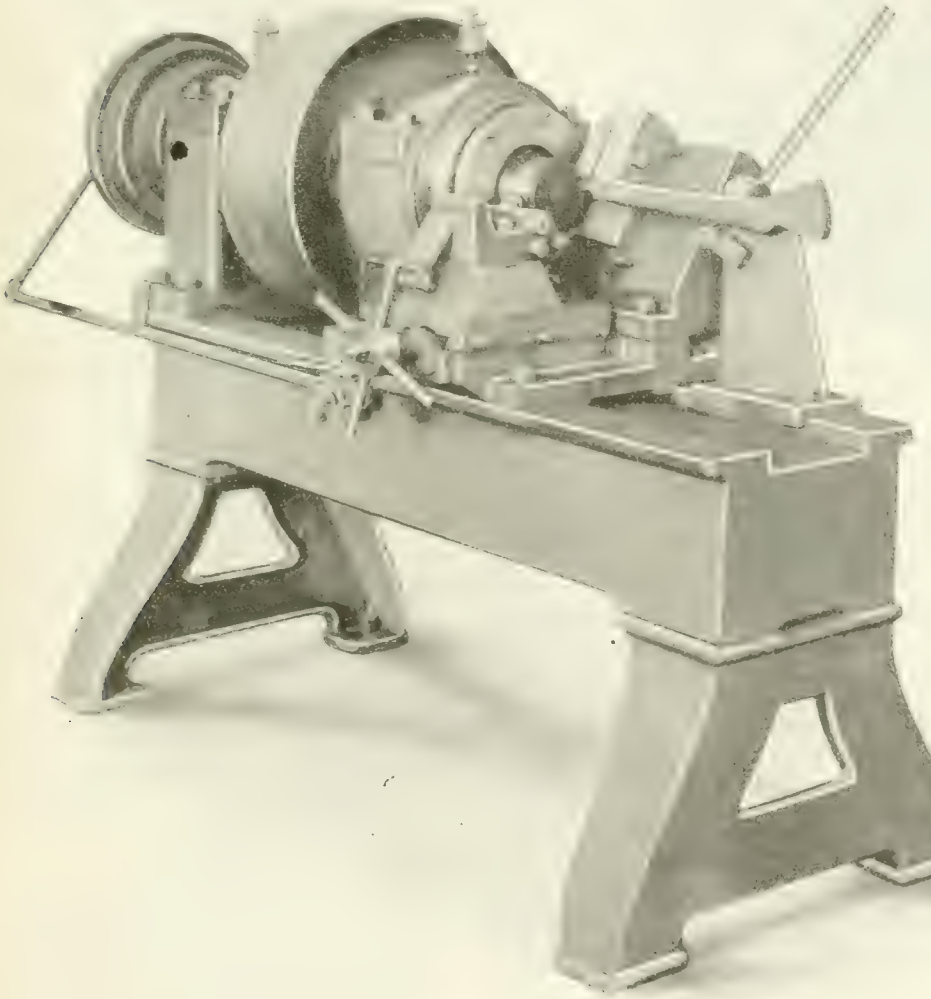
The bed is of the heavily ribbed flat top type, and is mounted on legs of standard type. In place of the regular headstock, two substantial capped bearings are used, each being secured to the bed by four suitable bolts. The bearing caps are machined, and are held by four studs. The bearing is 6 in. diameter by 7 in. long, being babbitted, bored, and finally scraped to the spindle. The spindle is a hollow steel casting, turned all over and finished by grinding. The drive is through a 22-in. by 8-in. clutch pulley mounted on the spindle and bronze bushed.

The clutch is of hard maple, cone type, and the full size of inside of pulley. It is operated by a compressed air piston controlled by a valve easily within reach of the operator's left hand. The clutch mechanism is all built into the spindle, and when in use has no tendency to move the latter endwise or cause end friction. Means are provided, however, for taking up end play of the spindle should wear occur. The chuck is operated by compressed air and is of the draw-in type. It is bolted into the large end of the steel spindle and controlled by the same valve mechanism as operates clutch.

The tool slide base is heavy and is clamped immovably to the lathe bed. The front or roughing tool is fed in by screw and hand wheel to a dead stop, and leaves a light cut for the finishing tool, while the finishing tool is mounted to the rear and above the work. The tool can be adjusted to pass down behind the shell, and in passing shave the band to size. The feed is by lever and pinion.

The tools can be removed for grinding, and be replaced with precision. They are held in steel blocks by a clamp gripping the dovetailed portion of the tool. The tools are formed of "Novo Superior" steel, 4½ in. long. The shell is located by a swinging finger on front tool block before the chuck is tightened.

A hinged scraper rest is provided on front tool block for removing the ragged edge at each side of band after tooling. No countershaft is required, the lathe being driven direct from the main line shaft of motor. About 10 horse-power is required to operate the machine, together with a small quantity of compressed air at available pressures.



COPPER BAND TURNING LATHE FOR 4.5 HIGH EXPLOSIVE SHELLS.

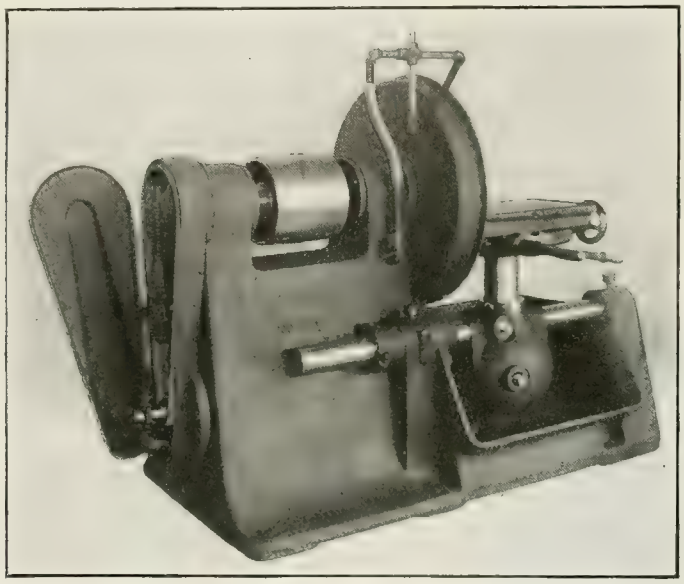
A NEW "GARDNER" GRINDER

IN bringing out this new machine, the manufacturers, the Gardner Machine Co., Beloit, Wisconsin, claim to have developed a disc grinder which has immeasurably broadened the possibilities of the disc wheel; a disc grinder which will not only handle with greater speed and accuracy all the work that their earlier types do, but a great number of additional operations which heretofore had been proven unsuited to this manner of machinery. It is a complete grinding unit, each machine being equipped with dust exhauster, water system and cast iron hood.

The machine is of unusual weight and rigidity. The total weight, without skids or crating, is 5,000 pounds. The spindle is made from the best crucible steel, turned and accurately ground to 3 inches in diameter. It is mounted in S.K.F. radial ball bearings of larger size than recommended by the manufacturers. The end play is also taken on thrust ball bearings of the same make. The spindle pulley is 12 inches in diameter, with a face for 10-inch double belt. The complete spindle is perfectly balanced and runs without sign of vibration.

The 4-inch diameter rocker shaft and counter weight are a one-piece casting, and weigh in the rough approximately 500 pounds. It is of particular importance to note that the rocker shaft has a

bearing at each end, and that it oscillates in the bearings when the table is rocked back and forth across the grinding wheel. This style of construction results in surpassing stiffness and rigidness, all of which make for greater accuracy and output. When the work being ground is forced against the grinding wheel, it will be understood there would be a tendency for the rocker shaft to move to right in its bearings. The heavy clamp collar just outside of the left bearing prevents this action. The other collar at the right serves two purposes: It is locked to the shaft against the end of the bearing, preventing the shaft from working to the left. The ledge on the under side of this collar and forming a part of it is provided with a curved, elongated slot, which acts around the stop screw. By adjusting this collar on the shaft and locking with the set screw, the limits of the oscillating motion of the table may be regulated.



A NEW "GARDNER" GRINDER.

The table column and top are solidly and rigidly constructed. The column is 5 inches in diameter, and when raised or lowered works within the counterweight, directly over the centre of the rocker shaft. When raised to the required height, it is held in position by the two locking screws passing through the left side of the counterweight. The graduated clamp collar, situated above the counterweight on the column, is employed when it is desired to set the table at an angle with the grinding wheel.

The finished top of the table has three ½-inch T-slots and measures 18 inches long by 10 inches wide. It is surrounded by a depressed channel, with the bottom cast on a down pitch, so that when wet grinding is done the water will rapidly drain into the basin below. The feed mechanism of the table—that is, the travel towards the grinding wheel, is a feature of this machine. Provision is made for either lever, screw or spring feed. When the lever feed is desired, the screw wheel is disengaged by removing a taper pin through its hub, and travel is accomplished by a pinion on the inner end of the lever shaft working in a rack attached to the under side of the table top. By lifting on the lever, a leverage of 56 to 5 is secured. The other handle mounted on the lever shaft, and which projects towards the front is used to assist in rocking the table. The positive screw feed is obtained by replacing the taper pin and turning the hand wheel to the right. A spring pressure of from 1 to 300 pounds can be had by turning up on the screw hand wheel when the latter is disengaged. When the spring feed is employed, the hand lever is used for giving any additional pressure wanted and for locking the table away from the grinding wheel. The micrometer stop screw in front accurately governs the forward movement of the table. The ways for the table top are formed by two heavy, flat gibs, and are thoroughly protected from grit or dust.

It should here be mentioned that this machine carries either a 30-inch diameter by 1¼-inch steel disc wheel or a 20-inch "Perfection" ring wheel chuck. The abrasive ring wheel is used when it is desired to do wet grinding and the disc wheel when dry grinding is done. The cast iron hood terminates at the extreme bottom with two openings, one for water and one for dust. When one of these openings is in use, the other is closed with hinged covers provided. When water is used, it falls into the main basin, from which it overflows into the removable reservoir shown at the rear of the machine. From here it is pumped up through the machine base and out at the adjustable nozzle directly on the work at the point of grinding contact. This water pump is of the gear type, and is driven from the machine spindle by sprockets and chain. The dust exhauster is contained within the machine base and is driven by belt. It is connected to the bottom of hood and discharges at the lower back of the machine. Here a thimble is provided for attaching to pipe. The front of the hood is enclosed with cast iron sections, one or more of which can be removed or inserted, making the opening adjustable for different sizes of work. The chain and belt driving the water pump and exhauster respectively are encased with a cast iron guard having a hinged door.

EFFICIENT USE OF LABOR IN THE FOUNDRY

By J. S.

SINCE the war began the writer has worked in four foundries, all of which have experienced the so-called shortage of labor. In such cases the employer's first thought should be as to whether he could increase the output of the men without overtaxing their strength, by supplying the materials to enable them to work quickly, but how many firms give their moulders or coremakers even all the tackle that should be regarded as necessary?

There are some, but very few founders who realize that a man cannot make his work safe and sound without the necessary tackle, and, moreover, they ignore the fact that tackle needs overhauling and repairing or replacing at times. There are few firms who keep a man to attend to the latter. The foreman or charge hand is perhaps supposed to do this, but the numerous other duties that keep him fully occupied, such as loading and unloading moulding boxes off the stove carriage, finding places to drop them so that they can be cored up and cast, giving jobs out, getting castings out, finding the defects and cause of bad ones, pouring metal when casting time comes round, and other items too numerous to mention that do not come under the heading of moulding or core-making, allow him little time for systematic attention to the men's tackle.

As an instance, two moulders were given employment in a certain foundry and were brought to the foreman or charge hand by a clerk from the office. They were given a pattern to mould, told to "get down here," and shown the box the casting had to be moulded in. The foreman then walked away.

Now, no doubt, these men were entire strangers to the place, and perhaps had not made a casting so heavy for five, ten or twenty years; or, on the other hand, they may have just come from a shop

where they had been on that class of work for years. They rammed the bottom part, turned the box over and proceeded to ram the cores up in green sand. The pattern was for a bed plate of 3 to 4 tons weight, made as a shell pattern to leave its own cores. This system needs a good, strong cast-iron grid to carry the body of sand in the lift, but the men had to make shift with any old cast-iron grid that they could find or make suitable, and these were mostly in halves or with prods off, staples missing, etc., all of which entailed more loose wrought irons.

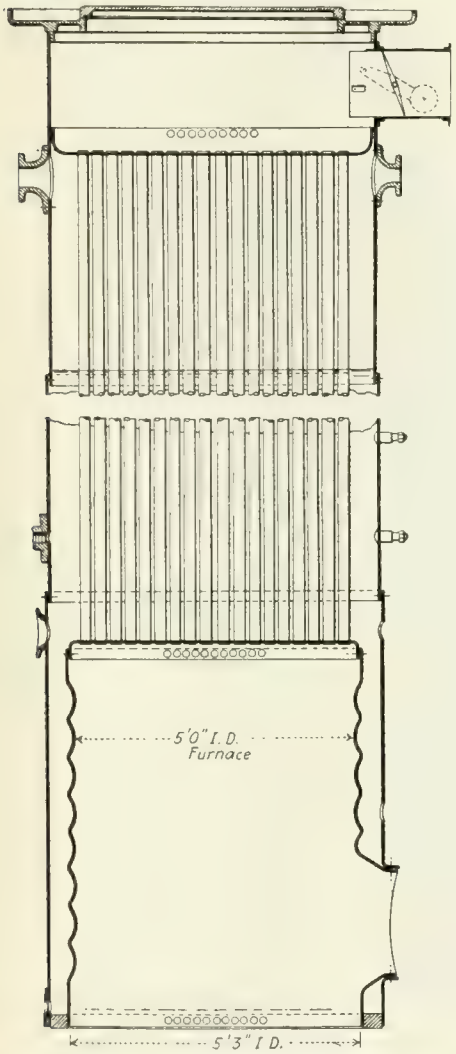


FIG. 1. SIMPLE DESIGN OF VERTICAL BOILER WITH CORRUGATED FURNACE

In cases like this, where the proper tackle is missing, the moulders often "risk it," and frequently there is a mishap, but who is to blame, the moulder for not using tackle which he had not, and although probably using his best endeavors to make the best of a bad job?

A moulder or core-maker who has acquired the methods of one firm is often not allowed to try them in another shop. In many jobs there is an alternative way that could well be adopted; but it makes a sensible man very cautious in following methods he considers best when the foreman, after the job is well started, pounces down upon him with "have you done this," or "don't do that," and finally orders the job to be started all over again on the customary methods of the firm (which, as a rule, are the foreman's methods), though there may perhaps be no better way than that followed by the new hand.—Foundry Trade Journal.

CORRUGATED FURNACES FOR VERTICAL FIRE TUBE BOILERS.

By F. W. Dean, Boston, Mass.

I HAVE been impressed for many years with the value of corrugated furnaces for vertical boilers, but only recently have actually used them. By the use of such furnaces, staybolts are done away with, and as there appear to be no disadvantages in the furnace this is a most important feature. As many hundreds of staybolts are avoided in each boiler there are just so many less opportunities for breakage and needed repairs. In the staybolted firebox it is necessary for safety to drill holes in the ends of the staybolts in order to know when they are broken.

The simplicity of vertical boilers with corrugated fireboxes must commend them to owners and makers. In the boiler shop the operations of building are of the simplest and most rapid kind. Again this type of firebox provides for expansion and contraction of the tubes in a safe manner, but on account of its somewhat flexible character it should be assumed that it is advisable to support the lower tube plate as near the edge as practicable. The ordinary firebox is rigid vertically and supports the edge of the lower tube plate, but as the corrugated firebox has slight elasticity it is best to hold up as much of the tube plate as practicable by the tubes and provide little or no elasticity in the tube plates. The flat and unstayed portions of the upper and lower tube plates should be made equal in diameter in order to balance.

The flanging of the fire door presents no difficulty, but it should be done so that the corrugations coalesce with the conical part. The behavior of the firebox end of the boiler when under pressure led to some speculation, for the area of the fire door opening theoretically unbalances it. When under hydrostatic pressure, various gauges were used for showing distortion, but none could be discovered.

In regard to sizes of such furnaces the catalogue of an American maker gives 60 in. as the maximum inside diameter, but, as a matter of fact, this concern can make them up to 72 in. diameter, and almost 1 in. thick. They have been made slightly larger in Germany and the furnace of the larger boiler illustrated was obtained in that country. If the inside diameter is 72 in., the grate will be 3 in. larger or 75 in. and the grate area 30.68 sq. ft. It is easy enough to generate 200 h.p. on a grate of this size with considerable capacity for forcing beyond that, and there is no difficulty in providing the heating surface for such horsepower.

In the matter of pressure, a furnace 72 in. in diameter and 0.95 in. thick will carry 200 lb. If there were sufficient demand for larger furnaces they would probably be forthcoming. The theory of heat transmission through plates, and experience, show that thick furnaces, especially if without riveted joints, are objectionable.

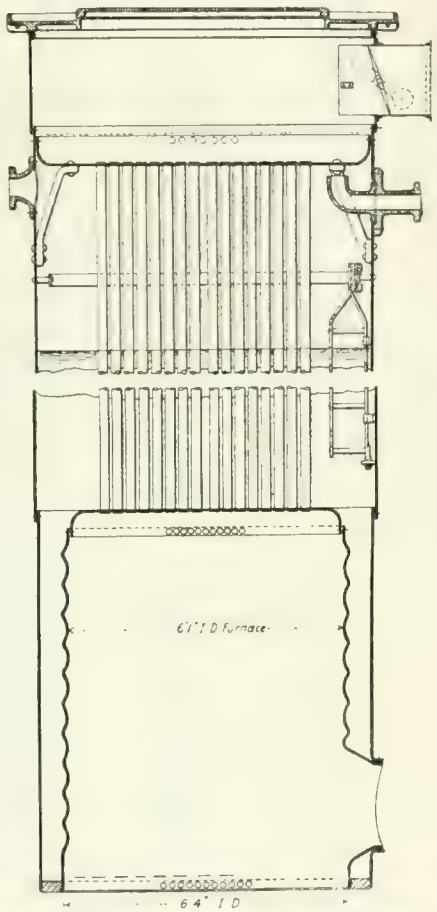


FIG. 2. LARGER BOILER OF THIS DESIGN WITH INTERIOR ACCESSIBLE FOR INSPECTION.

The introduction of corrugated furnaces for the fire boxes of the vertical type of boiler is, I think, a real improvement in steam boilers. The type possesses the important qualities of giving maximum and permanent economy, superheating the steam from 20 deg. to 40 deg., being free from brickwork and requiring small floor space per horsepower.

Fig. 1 shows a boiler of the simplest possible design, two of which have been in use for a year and a half, and Fig. 2 shows one with the interior accessible for inspection and cleaning which has been in use a few months only.

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PEACE-TIME PURSUITS DUE FOR DEVELOPMENT

THE much heralded visit to Canada of D. A. Thomas, the representative of the British Ministry of Munitions did ultimately materialize. Its duration was brief, its programme commonplace and its value problematical. What Mr. Thomas did not know concerning our munitions output and facilities to maintain and enlarge same previous to his advent here were, we should say, comparatively easy of acquirement during his sojourn in our midst. Appearances are rather favorable to a quite generally developing impression that the Thomas visit bears on its face the sole purpose construction—to find out our minimum—with—contentment, so far as the placing of further shell contracts are concerned.

The war is now over thirteen months old and for the major portion of this period Canadian engineering and metal-working plants have been contributing their called-for quota of various type shells. Further, we have organized and equipped to maintain an indefinite quantity supply and have said so earnestly and often. It has, however, seemed to us that compared with the huge orders for war munitions placed in the United States, we were merely crumb gatherers. Organization of interests engaged in shell production gives at once concrete expression to the dissatisfaction felt and to the desire to have opportunity to supplement Empire service by placing increased shell manufacturing capacity at headquarter's disposal. At least two such organizations are in existence, one being representative of our larger engineering and metal-working plants and another of several of our smaller and medium-size plants.

On more than one occasion we have hinted at the probability of shell manufacture in Canada being in the nature of a stop-gap, basing our opinion on the fact of the unpreparedness of British plants to cope with the then demand for shells. The position in Britain, however, is no longer one of unpreparedness. She is nothing short of being one huge ammunition and war supplies factory, equipped with men and machines drawn from every possible source, home and abroad, and organized to ensure an almost self-contained output which will not only last the war, but settle it as she and the worth-while world desires it settled.

Canada and the United States may both take to heart this fact of the war situation, not only as it refers to Great Britain, but to her Allies as well. Men and munitions have been piling up prodigiously these past months, and outputs have been increasing by leaps and bounds. Lloyd George, Britain's Minister of Munitions, is reported to have given out the following statement relative to the latter: Taking the figure 1 as representing the munitions output of British factories in September, 1914, the figure for July, 1915, is 50 times greater. In August, 1915, it will have been 100 times greater and from there onwards the output curve will continue its upward course.

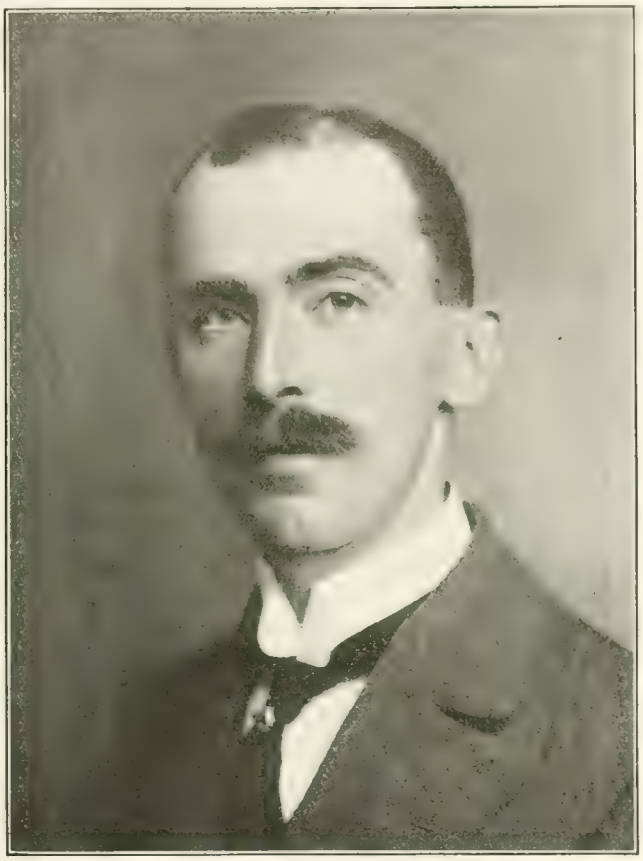
In the past few weeks quite a full realization of the munitions production position in Britain has dawned on the administrations of American financial houses, hence the gallery display of a favorable trade balance while the opportunity is still available. The mission of D. A. Thomas, both here and in the United States, has, we are inclined to believe, been so far as munitions are concerned of a contract-cancelling, stop-order or closing-out nature, and although orders may continue to be placed in both countries while the war lasts, they will be more or less supplemental and comparatively small. In view of this we offer the opinion that contracts will be divided for the most part among the larger and specially equipped Canadian establishments.

Authorities are generally agreed and uncertainty no longer cuts any figure, that an all along the line Canadian crop record has been established. Such a happening in peace or normal times would be the signal for an impetus to every form of industrial and manufacturing development within our borders. A little loosening up here, and a display of old-time enterprise there will easily get good times off to a fair start again. Our engineering and metal-working plant capacity and equipment was never in such shape for handling business—war and peace-time, new and old, home and foreign, and it only needs our big spenders—the railroads to make a beginning, there being the absolute assurance that the little fellows all the way down will quickly join in.

CANADIAN SHIPBUILDERS

THE Collingwood Shipbuilding Co., Ltd., Collingwood, Ont., of which Mr. John S. Leitch is general manager, is one of the most important shipbuilding, engineering and repair plants in Canada, possessing, as it does, two excellent drydocks, commodious building berths with overhead electric crane equipment, engine and boiler shops, foundry and other customary buildings necessary for an up-to-date establishment of its kind. In addition, work is now being carried on night and day producing shells, the company having installed equipment for the manufacture of both shrapnel and high explosive shells.

Mr. Leitch, who is 35 years of age, has been with the Collingwood Company for over three years, and is responsible to the directors for the management of the entire plant. Under his guidance an interesting variety of vessels, with their propelling machinery, has been successfully produced, including such widely different types as 550-foot bulk freighters, powerful bucket ladder dredges for service in the St. Lawrence ship channel, lighthouse and buoy vessels, hopper barges for the Dominion Government ser-



JOHN S. LEITCH.

vices, passenger vessels, etc. Recently an order for two large bulk oil steamers has been secured. It will therefore be seen that the company is enterprising and progressive.

In addition to new construction, a considerable quantity of repair work is overtaken, the most interesting of the later jobs being the straightening and reconstructing of the large freighter "Howard M. Hanna, Jr.," which came to grief in the memorable gale of November, 1913.

Mr. Leitch, who hails from Portpatrick, in the south of Scotland, gained his technical and practical experience in the three largest British shipbuilding centres, viz., the Clyde, Tyne, and Belfast, having been successively employed by the late firm of Robert Napier & Sons, Glasgow; Swan, Hunter & Wigham Richardson, Neptune Works, Walker-on-Tyne, and Workman, Clark & Co., Ltd., Belfast.

Starting in the shops as an ordinary apprentice, Mr. Leitch has risen rapidly to the highest position in the shipbuilding profession. He resigned from the position of assistant manager with Workman, Clark & Co. in order to take up his appointment in Collingwood

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh		$14 45
Lake Superior, charcoal, Chicago		16.25
Ferro Nickel pig iron (Soo)		25 00
	Montreal.	Toronto.
Middlesboro, No. 3	22 00	.....
Carron, special	23 00	.....
Carron, soft	23 00	.....
Cleveland, No. 3	22 00	.....
Clarence, No. 3	22 50	.....
Glengarnock	26 00	.....
Summerlee, No. 1	28 00	.....
Summerlee, No. 3	27 00	.....
Michigan charcoal iron	26 00	.....
Victoria, No. 1	23 00	19 00
Victoria, No. 2X	22 00	19 00
Victoria, No. 2 plain	22 00	19 00
Hamilton, No. 1	22 00	19 60
Hamilton, No. 2	22 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Twisted reinforcing bars	2.20
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.30
Tank plates, Pittsburgh	1.30
Beams and angles, Pittsburgh	1.30
Steel hoops, Pittsburgh	1.40
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.90
Structural shapes	1.95
Plates	1.95

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$11 00	$11 75
Copper, crucible	12 00	12 50
Copper, unch-bled, heavy	12 00	12 50
Copper, wire, unch-bled	13 00	13 50
No. 1 machine compos'n	11 00	11 00
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	7 00	7 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	11 00	11 00
No. 1 brass turnings	9 00	9 00
Heavy lead	4 50	4 75
Tea lead	$ 3 25	$ 3 50
Scrap zinc	8 50	9 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect Aug. 27, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	38½	....	....
½ in.	68	47½	....	....
¾ to 1½ in.	73	52½	....	....
2 in	73	52½	69	48½
2½ to 4 in	73	52½	72	51½
4½, 5, 6 in.	....	....	70	49½
7, 8, 10 in.	....	....	67	44½
X Strong P. E.				
¼, ⅜ in.	56	38½	....	....
½ in.	63	45½	....	....
¾ to 1½ in.	67	49½	....	....
2, 2½, 3 in.	68	50½	....	....
2 in.	....	....	63	45½
2½ to 4 in.	....	....	63	48½
4½, 5, 6 in.	....	....	66	48½
7, 8 in.	....	....	59	39½
XX Strong P. E.				
½ to 2 in.	44	26½	....	....
2½ to 6 in.	....	....	43	25½
7 to 8 in.	....	....	40	20½
Genuine Wrot Iron.				
⅜ in.	57	32½	....	....
½ in.	62	41½	....	....
¾ to 1½ in.	67	46½	....	....
2 in.	67	46½	63	42½
2½, 3 in.	67	46½	66	45½
3½, 4 in.	....	....	66	45½
4½, 5, 6 in.	....	....	63	42½
7, 8 in.	....	....	60	37½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$20 00	$19 50
Electrolytic copper	19 75	19 25
Castings, copper	19 00	19 00
Tin	39 00	39 00
Spelter	19 00	19 00
Lead	6 50	6 50
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$23 50
Openhearth billets, Pittsburgh	24 00
Forging billets, Pittsburgh	30 00
Wire rods, Pittsburgh	28 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1¼in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

MISCELLANEOUS.

Solder, half-and-half	24.75
Putty, 100-lb. drums	2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.62
Linseed oil, raw, single bbls.	0.65
Linseed oil, boiled, single bbls.	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.10
Pure Manila rope	0.16
Transmission rope, Manila	0.20
Drilling cables, Manila	0.17
Lard oil, per gal.	0.73
Union thread cutting oil	0.60
Imperial quenching oil	0.35

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

IRON PIPE FITTINGS.

Canadian malleable, 35 per cent.; cast iron, 60; standard bushings, 60; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$2 90
Canada plates, dull, 52 sheets	3 25	3 50
Canada Plates, all bright	4 40	4 60
Apollo brand, 10¾ oz. galvanized	6 40	5 95
Queen's Head, 28 B.W.G.	6 00	6 25
Fleur-de-Lis, 28 B. W. G.	5 75	5 75
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	5 38	5 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$11 00	.....
1¼ in.	11 00	.....
1½ in.	11 00	.....
1¾ in.	11 00	.....
2 in.	11 50	9 20
2¼ in.	13 00	.....
2½ in.	14 00	12 10
3 in.	16 00	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 09
X Press	0 08¼
COLORED.	
Lion	0 07½
Standard	0 06¾
Popular	0 06
Keen	0 05½
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	50 & 10%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

PLATING CHEMICALS.

Acid, boracic	$ .15
Acid, hydrochloric	.05
Acid, hydrofluoric	.06
Acid, Nitric	.10
Acid, sulphuric	.05
Ammonia, aqua	.08
Ammonium carbonate	.15
Ammonium chloride	.11
Ammonium hydrosulphuret	.35
Ammonium sulphate	.07
Arsenic, white	.10
Copper sulphate	.10
Cyanide of potassium (95 to 96%)	.35
Iron perchloride	.20
Lead acetate	.16
Nickel ammonium sulphate	.10
Nickel carbonate	.50
Nickel sulphate	.20
Potassium carbonate	.40
Potassium sulphide	.30
Silver chloride (per oz.)	.65
Silver nitrate (per oz.)	.45
Sodium bisulphite	.10
Sodium carbonate crystals	.04
Sodium cyanide	.35
Sodium hydrate	.04
Sodium hyposulphite (per 100 lbs.)	3.00
Sodium phosphate	.14
Tin chloride	.45
Zinc chloride	.20
Zinc sulphate	.08

Prices Per Lb. Unless Otherwise Stated.

ANODES.

Nickel	.47 to .52
Cobalt	1.75 to 2.00
Copper	.25 to .28
Tin	.45 to .50
Silver	.55 to .60
Zinc	.30 to .33

Prices Per Lb.

PLATING SUPPLIES.

Polishing wheels, felt	1.50 to 1.75
Polishing wheels, bullneck	.80
Emery in kegs	.4½ to .06
Pumice, ground	.05
Emery glue	.15 to .20
Tripoli composition	.04 to .06
Crocus composition	.04 to .06
Emery composition	.05 to .07
Rouge, silver	.25 to .50
Rouge, nickel and brass	.15 to .25

Prices Per Lb.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents

Toronto, Ont., September 7, 1915.—The Canadian National Exhibition now being held here is exciting considerable interest as usual, and the exhibits in the Machinery Hall are quite up to the standard of previous years, notwithstanding the war. A number of exhibits, as might be expected, feature machinery or materials used in connection with the manufacture of munitions.

The general industrial situation continues to improve, and the large crop which is now practically assured will have a bracing effect in business circles and stimulate domestic trade. The principal development, however, has been recently, and will continue to be in export trade. The expectation of improvement in transportation facilities by increase of tonnage will benefit export trade considerably, it having been handicapped in this respect of late.

Steel Market.

The mills continue working to capacity and the situation in the steel trade is very favorable. This year promises to be a record one for those steel plants who are producing shell forgings and other war material. The business is almost entirely for export, the output being very light for ordinary domestic trade.

The high-speed tool steel situation, is becoming increasingly serious as the demand continues to increase without any corresponding improvement in the supply. Stocks of the sizes most called for are getting very low, and dealers are having the greatest difficulty in filling orders to satisfy everybody as some firms are asking for comparatively large quantities.

Galvanized sheets are firmer following the advance in spelter, but no price changes have been made meanwhile. Makers of galvanized sheets with few exceptions, have either withdrawn from the market or are only quoting on specific tonnages for immediate shipment. The galvanized market is unsettled, and there is little hope of any stability until spelter prices attain fixed level. Prices of galvanized pipe have been reduced following the weakness in the spelter market. The new prices which are given in the selected market quotations represent a reduction of about 10 per cent. The pipe market, however, is unsettled, as the change was decided upon before the recent advance in spelter. If spelter remains at the present level or advances further, higher prices for galvanized pipe may be expected.

Increasing activity prevails in the steel trade in the States and most steel works are now pretty well sold up on their production until the end of the year. The demand for steel rounds for shells is constantly assuming greater proportions, and there is also a heavy demand for barb wire. Prices on bars, plates, and shapes are firmer, and some business has been closed at 1.35c Pittsburgh. Prices on billets are higher, Bessemer being quoted at $23.50, open hearth billets at $24 and forging billets at $30 f.o.b. Pittsburgh. Wire rods have advanced, and are now quoted at $28 Pittsburgh.

Pig Iron.

The market is firm but the general situation is unchanged. There is a good demand for steel-making pig iron, but foundry grades are quieter. Prices are unchanged but firm.

Machine Tools.

The situation in the machine tool market, is much the same as has prevailed during the last few weeks. Many builders of machine tools are in a sold-up condition and deliveries are very backward. There is a fair demand for new tools, and builders of special machines are doing good business. The demand for second-hand tools continues active, principally on account of the difficulty in obtaining quick delivery on new tools.

Supplies.

There is apparently no falling off in the demand for machine supplies and small tools. Prices generally are unchanged but very firm, with the exception of turpentine which has declined two cents and is now quoted at 62 cents per gallon. Prices of leather belting are very firm on account of the scarcity of raw material.

Metals.

There are no important price changes to note this week, and the metal market is steady and firmer. Lead has made a slight advance but prices of all other metals are unchanged. The extraordinary fluctuation in sterling exchange has unsettled the metal market and is having a tendency to restrict business. The general situation, however, is unchanged and business continues good for metals for munitions. The New York Metal Exchange was closed yesterday, being Labor Day.

Tin.—The London Market has advanced slightly, but New York is steady and firm. The fluctuations in sterling exchange are affecting the market and importers are shy at committing themselves to dollar equivalents, and prefer to sell in sterling. Locally tin is unchanged but firm at 39 cents per pound.

Copper.—The market is extremely dull at unchanged prices and there is little of importance to note. The sharp recovery in sterling exchange has greatly improved prospects of export sales. Copper is quoted locally at 19½ cents per pound.

Spelter.—The market for spelter has been restored and good export sales are reported. The market is holding firm, and gives every indication of an advance. Local quotations are unchanged and nominal at 19 cents per pound.

Lead.—The market is firm at the "Trust" price of 4.90c. New York, but domestic enquiry is light. The London market is strong and advancing. Lead has advanced ¼ cent locally, and is now quoted at 6½ cents per pound.

Antimony.—The situation is much the same and the market is quiet. Quotations are unchanged at 40 cents per pound.

Aluminum.—The market is firm and quotations are nominal at 40 cents per pound.

Building Notes

Quebec, Que.—The foundation stone of the new Union Station, was laid by Mayor Drouin, on Aug. 12. H. E. Pringle of Montreal, is the architect.

Vancouver, B.C.—The Department of Public Works, Ottawa, will call tenders shortly on the construction of two large sheds on the new wharf. Approximate cost will be $250,000.

Toronto, Ont.—The Toronto Hydro Electric Commission, 226 Yonge street, are having plans prepared for a sub-station to be erected at St. Lawrence Market, at an estimated cost of $5,000.

Kerrobert, Sask.—Messrs. Badger and Son, of the Badger Flour Mills and Elevator Co., have started work on the construction of a new elevator at this point.

Hamilton, Ont.—Laing & Sons, manufacturing confectioners, have secured a permit for the erection of a factory at 169 and 171 King William street, to cost $8,000. Ground has already been broken for the building.

Winnipeg, Man.—Contractors Hazelton & Webb have been instructed to begin work on the reconstruction of the Scott Block on Main street, Pratt & Ross are the architects and the cost is estimated at $125,000.

Tavistock, Ont.—The Carnegie Library Corporation has agreed to furnish $7,500 for a library in Tavistock, and at the meeting of the council recently it was agreed to provide a site and support the institution to the extent of $750 a year.

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CANADIAN AGENTS: Williams & Wilson, Limited, Montreal.
The A. R. Williams Machinery Co., Limited, Toronto, Winnipeg, St. John, N.B.

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INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Sherbrooke, Que.—The Eustis Mining Co. plant has been destroyed by fire, the loss being estimated at $50,000.

Murray Bay, Que.—The boiler-room and laundry at the Manoir Richelieu have been destroyed by fire, the loss being estimated at $20,000.

Brighton, Ont.—The D. J. Barker Foundry Co. have let the contract for the erection of a foundry to Thomas Garnett & Sons, Port Hope. Estimated cost, $13,000.

Burnaby, B.C.—The Shell Oil Co. will spend $110,000 on improvements and buildings to be constructed at its plant as well as the erection of six tanks with a capacity of from 5,000 to 38,000 gallons each.

Hamilton, Ont.—The Canadian Horse Shoe Co. which was recently incorporated with a capital stock of $300,000, is erecting a plant which will represent an outlay of $150,000. The plant will ultimately require the addition of a rolling mill.

Chatham, Ont.—Representatives of an automobile concern, believed to be located in Brantford, are negotiating with the Canadian Wolverine Mfg. Co. for the purchase of their plant on St. Clair Street, apparently with the object of starting the manufacturing of automobiles here. The Wolverine Co. has decided to discontinue manufacturing certain lines of brass goods, but have not formulated definite plans for the future.

Municipal

Thetford Mines, Que.—A waterworks system will be installed at a cost of $12,000.

New Westminster, B.C.—The City Council are considering laying a 14-in. water main to cost $15,000.

Edmonton, Alta.—A by-law is contemplated to raise $250,000 for the building of a sewage disposal plant.

Guelph, Ont.—The city will spend $24,500 on extensions to be made to the water works plant. F. McArthur is the engineer.

Listowel, Ont.—The by-law providing for the construction of a waterworks system has been carried, and tenders will be called shortly. Approximate cost, $5,400.

Cochrane, Ont.—The Town Council will shortly call for tenders on extensions to the water and sewerage systems.

Welland, Ont.—A by-law will be voted on by the ratepayers on Sept. 20 to fix an assessment of $5,000 for ten years to the Weedon Mining Co., who propose establishing a zinc smelter here.

Youngstown, Alta.—A by-law is contemplated to provide $8,400 for the purchase of fire apparatus, sinking well, building fire hall, and putting in tank and reservoir.

Markham, Ont.—The village council have decided to submit a by-law to the ratepayers on October 2, authorizing the raising of $20,000 for the construction and installation of a modern waterworks system.

St. Hyacinthe, Que.—A by-law will be submitted to the ratepayers on September 16 providing for the construction of gravity filters and the installation of two pumps, motor, boilers, pipe connections, valves, etc., estimated to cost $75,000.

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen, constitute the Commission appointed to make all purchases under the Dominion $100,000,000 was appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Owen Sound, Ont.—At a joint meeting of the Utilities Commission and the Finance and Fire Committees held on September 1, it was decided to recommend to the council the extension of the high pressure waterworks system to the factory district on the west side of the town. It is estimated that the cost of the proposed extensions will be in the neighborhood of $5,000.

Electrical

Dutton, Ont.—Hydro was officially turned on here on August 30 by Sir Adam Beck.

Harriston, Ont.—At a special meeting of the Town Council the hydro-electric by-law, recently approved by the ratepayers, was given its third reading.

Chatham, Ont.—At a meeting held at Kent Centre on August 20 farmers of the district decided to have an engineer prepare estimates of the cost of erecting a hydro distributing line into that part of the county.

General Industrial

Winnipeg, Man.—The Auto Light Gas Mfg. Co. will build a new plant at 462 Lipton street.

Ottawa, Ont.—The Ottawa Sanitary Laundry Co. is building a new laundry at an estimated cost of $40,000. M. M. Pyke is manager.

Winnipeg, Man.—The Concrete Post Co., which already has factories in Saskatchewan and Ontario, has recently secured quarters for a factory in Winnipeg situated on James street east.

Cochrane, Ont.—The Metagami Pulp & Paper Co. are about to commence operations in connection with the establishment of a pulp and paper mill on the Metagami River, thirty miles west of this place

Building Notes

Montreal, Que.—A permit has been issued to the Ogilvie Flour Mills Co. for alterations to their mill here. The cost is estimated at $3,500.

Port Arthur, Ont.—A permit has been issued to the National Elevator Co. for the erection of an elevator at Third Avenue and King street. Approximate cost, $15,000.

Hamilton, Ont.—The Canadian Cartridge Co. have secured a permit to extend their office building at a cost of $2,000. Christman & Co. have the contract.

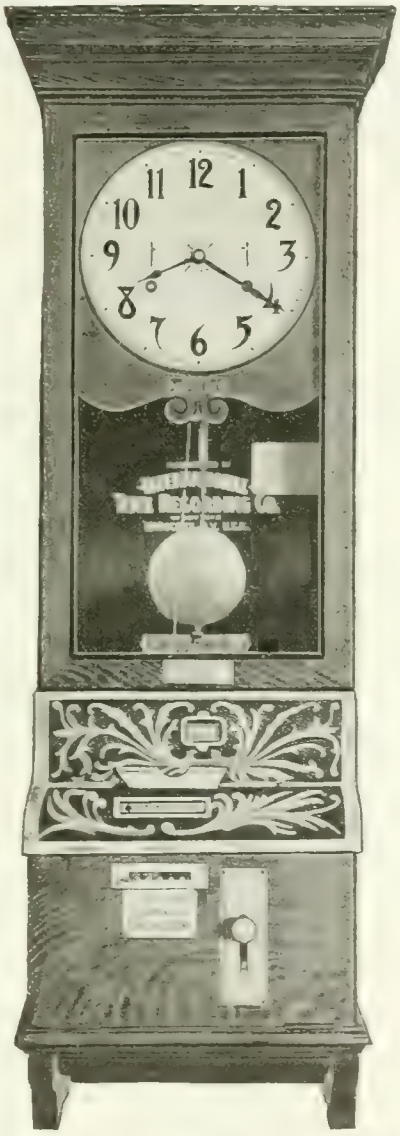
Winnipeg, Man.—All the tenders for the new Ford building to be erected at the corner of Portage Avenue and Wall Street are now in, the time limit having expired.

Winnipeg, Man.—Work has started on a contract which the Carter-Halls-Aldinger Co. has obtained for the erection of a big assembling plant for the Ford Company at Portage avenue and

Have You Asked This Question:

"Which is the best Time Recording System for me to buy"—

The Individual Time Card or the Dial Recorder?



$95

Is the price of this International Time Card Recorder. Prices up according to style and size.

YOUR business may demand one or the other. We make both; but the great majority of users to-day prefer the Individual Card System—and the following are some of the reasons as compiled by our Research Department:

1. The Individual Card—that is a separate time card for each employee — is very valuable because of THE GREATLY INCREASED PUBLICITY AT THE TIME OF RECORDING which to a vast extent eliminates the possibility of one employee registering for another.

2. GREAT FLEXIBILITY OF THE CARD SYSTEM, which allows an "In CARD RACK" to be placed in each department, locked and opened only by the foreman, which does away with the loss of time, heavy in the aggregate, of the employee loitering between the Recorder and his bench. This check is impossible with the Dial Recorder.

3. The employee has more confidence in the Card System. He can see for himself that the record, at the time he makes it, is fair and correct, saving future disputes and giving him the proper mental attitude towards the recording system.

4. In making up the pay roll the Individual Time Cards can be divided amongst several of the office staff, so that the work can be quickly done. With the Dial System one clerk only, can handle the record.

5. The two-color registration, the red showing every "late time in" and every "early time out," is an intensely valuable feature as every employee sees his own card 24 times a week, impressing him EVERY TIME WITH HIS OWN TARDINESS OR SLACKNESS.

6. RELATIVE COST.—The Individual Time Card System is, generally speaking, less expensive than the Dial Recorder.

Point Number 2—FLEXIBILITY—explained above has brought about in thousands of plants the use of an Individual Card System in each department which not only saves the walking time but increases the output. This naturally reduces the overhead. This feature has been commented upon in hundreds of letters received from time to time by our users.

Why not take advantage of our skilled advice in selecting a Recording System that will save you money four times a day every working day in the year. Let us hear from you—writing for information puts you under no obligation to buy.

International Time Recording Company of Canada

LIMITED, TORONTO, CANADA

Offices: Ryrie Bldg.
Cor. Shuter and Yonge Sts.

F. E. MUTTON
Manager

Wall street. The building, which will cost about $200,000, will be of reinforced concrete, with exterior walls of red, pressed brick. It will be 200 feet by 150 feet, and will be four storeys high.

Contracts Awarded

Berlin, Ont.—The Kaufman Rubber Co. has received an order for hip boots from the British Government, valued at $40,000.

James Malcolm, of the Andrew Malcolm Furniture Co., Kincardine, Ont., has secured a contract for the making of shell boxes.

Lachine, Que.—The contract for the construction of an incinerator has been let by the City Council to the Atlas Construction Co., Montreal, at $9,000.

Point Pelee, Ont.—The contract for the erection of a lighthouse tower has been let by the Department of Marine and Fisheries, Ottawa, to Charles Mattaini, Fergus, Ont., at $8,490.

Toronto, Ont.—Contract for supply and installation of 7,000 ft. 13,200 volt, paper-insulated, lead-covered cable has been awarded to Eugene Phillips Electrical Works, Montreal, by the Toronto Hydro-Electrical System.

Maillardville, B.C.—The Widdess, McDonald Co., of Vancouver, have been awarded the contract for supplying the material necessary for the installation of the Maillardville water system at a figure of $3,249.25 by the Coquitlam Council.

Drumheller, Alta.—The following contracts have been awarded in connection with the installation of the waterworks system:—E. R. Leverton, Calgary, construction of system, $5,170; elevated tank and housing, Vancouver Wood Pipe & Tank Co., Vancouver, $1,145; duplex pump, Canadian Western Foundry & Supply Co., Calgary, $410; boiler, etc., E. Leonard & Sons, Ltd., Calgary, $1,127; hydrants, Empire Waterworks Supply Co., Winnipeg, $47.11 each; 6-inch valves, Canadian Western Foundry & Supply Co., $10.77 each; 6-inch steel pipe and specials, General Supplies, Ltd., Calgary, 59c per foot.

New Incorporations

The Patent Grates Co. has been incorporated at Ottawa, with a capital of $50,000, to manufacture patent boiler grates at Sorel, Que. Incorporators—Arthur Langlois, Francis Hurtubise, of Montreal.

The Burnall, Ltd., has been incorporated at [illegible] with a capital of $100,000, to manufacture lighting and heating plants at Toronto. Incorporators—Bessie Cook, William Henry Latimer, of Toronto.

Everyman's Car Co. has been incorporated at Ottawa with a capital of $40,000 to manufacture motor cars, trucks and motor vehicles of all kinds at Ottawa. Incorporators, Arthur Meredith Jacques, Frank H. Jacques, and Charles A. Jacques, all of Montreal.

British-American Chemical Co. has been incorporated at Ottawa with a capital of $50,000 to manufacture chemical for medicinal and industrial purposes at Montreal. Incorporators, Errol Languedoc, Ralph Erskine, Allan and Ernest Copeland, all of Montreal.

The Excel Chemical Co. has been incorporated at Ottawa, with a capital of $1,000,000, to manufacture all kinds of chemicals, explosives and other products of a similar nature at Montreal, Que. Incorporators—Eugene H. Godin and Joseph E. Morier, all of Montreal.

The Flexible Metal Hose Co. has been incorporated at Ottawa, with a capital of $200,000, to take over the business of Charles Forth, manufacturer of flexible metal hose and other products. Incorporators—James B. Watson, Francis E. Higgerty, of Ottawa.

The Zinc Co. has been incorporated at Ottawa, with a capital of $100,000, to operate zinc mines and smelters at Sherbrooke, Que. Incorporators—Leland Drew Adams, Charles Herbert Maxey, of Oaklands, Cal., and John Perley Wells, of Sherbrooke, Que.

The Capital Electric Co. has been incorporated at Ottawa, with a capital of $40,000 to carry on business as ironfounders and machinists at Ottawa, Ont. Incorporators, Robert P. Moodie, Edward Thomas Headley and Bernard Gillies, all of Ottawa.

The Russell Fireproofing Co. has been incorporated at Ottawa with a capital of $250,000 to manufacture fireproofing materials, brick and tile, etc., at Russell, Ont. Incorporators, Andrew Walker, Hiram Kenney and James A. Cochrane, all of Russell, Ont.

ALLIES' PURCHASING AGENTS

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian.—Messrs. S. Ruperti and Alexsieff, care Military Attache, Russian Embassy, Washington, D.C.

Marine

Port Arthur, Ont.—The steamers Turret Cape, Turret Chief and Paliki are to be added to those formerly on the Great Lakes and now doing service on the Atlantic. All were ocean-going vessels before being brought to the lakes.

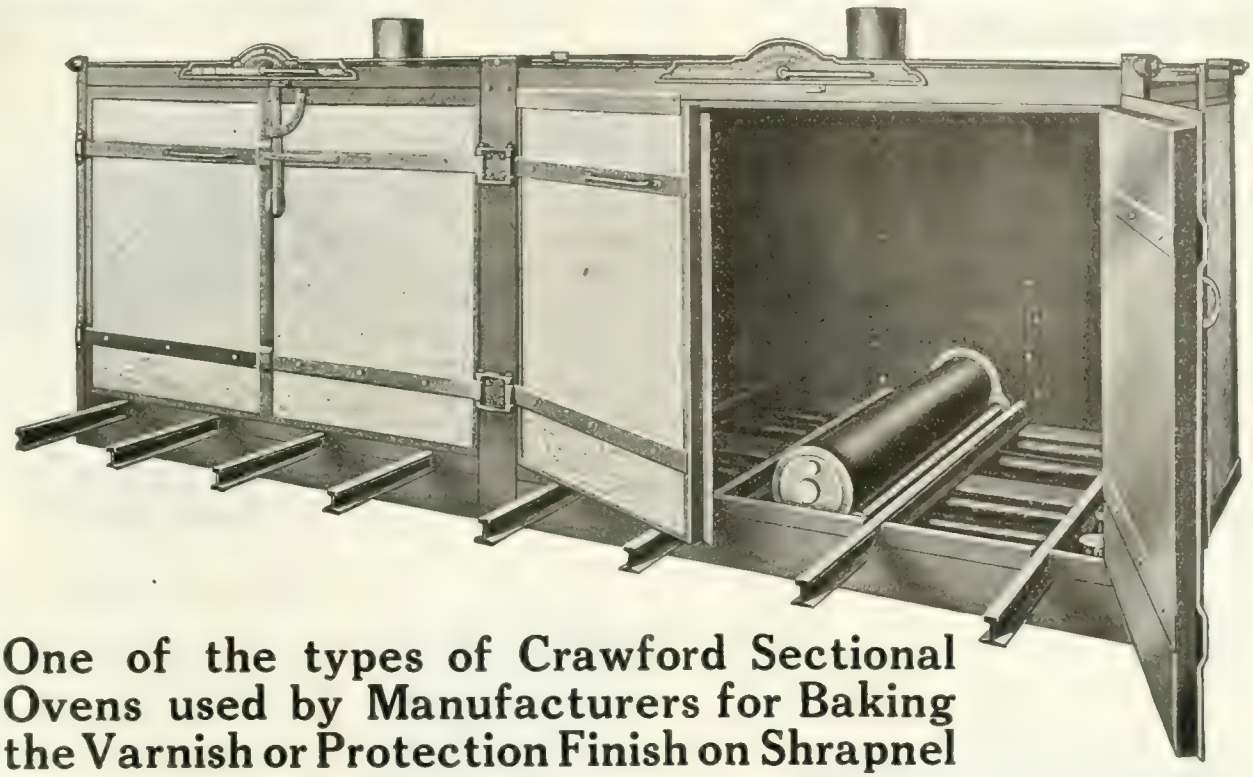
Steamer Condemned.—The steamer Helen R., plying between North Bay and the French River, has been condemned by Government officers, and is now laid up at the wharf, North Bay. She failed to carry the necessary lifeboats and belts as required by law.

Submarine Destructiveness.—Lloyd's official report for the quarter ended August 12 gives the loss to British shipping by submarines as 77 vessels. At that fearful rate, says the Wall Street Journal, there won't be anything left of the British merchant marine in 200 years.

Montreal, Que.—After spending five weeks in dry dock at St. John's, Newfoundland, the steamer Polan Hall arrived in Montreal on September 2. In a dense fog the vessel ran into a short cliff, about 100 feet high, just north of Cape Race, and pounded on a rocky bottom for an hour before being relieved.

New Brunswick Shipping Situation.—The announcement has been made that the British deck-load law will not come into operation this year until November 15. This will mean that steamships with summer deck-loads will be able to clear from New Brunswick ports up to November 1 at least. This extension will mean a period of greatly increased activity at St. John. So far this year the summer shipping business has been ahead of last year.

Montreal, Que.—The master of the steamer Alexandria, Captain William Bloomfield, was justified in his action in beaching the vessel, in a judgment given on September 3, by Captain L. A. Demers, Dominion Wreck Commissioner. The Alexandria was lost in a hurricane off Scarboro Bluffs, near Toronto, on August 3. The master ran her on the beach and she went to pieces. The commissioner finds no fault with this ac-

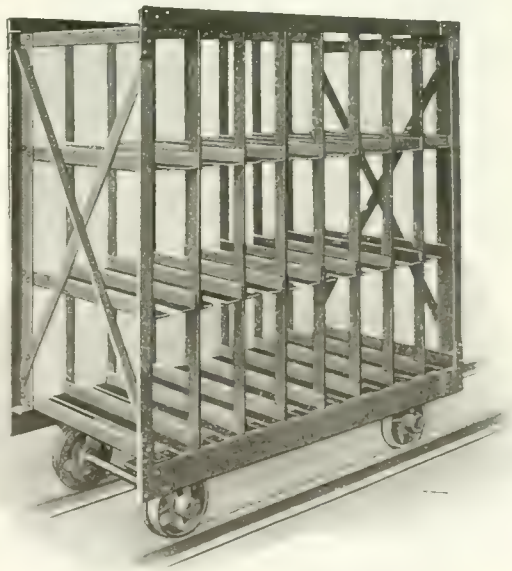


One of the types of Crawford Sectional Ovens used by Manufacturers for Baking the Varnish or Protection Finish on Shrapnel and High Explosive Shells.

These ovens are equipped with the only gas burner that gives a combined radiated heat and circulation of pre-heated air in the oven.

The gas and air are mixed and combustion in the large cylinder supported by air from a positive pressure blower which gives the highest efficiency and economy known for burning either city, natural, gasoline or producer gas, and there is no exposed flame in the oven.

The truck shown holds (120) twenty-eight-pound shells and is planned to stand the shells on end, resting on angles. Other designs have been built for shells ranging in weight from fifteen to eight hundred pounds, the last mentioned shell being forty-eight inches high by twelve inches in diameter.



The Oven Equipment & Manufacturing Company

NEW HAVEN, CONN., U.S.A.

Canadian Representatives: THE A. R. WILLIAMS MACHINERY CO., LIMITED, TORONTO, CANADA

Rumely-Wachs Machinery Co.

121 N. JEFFERSON ST.

CHICAGO ILLINOIS

A Few of Our Second-Hand Tools in Stock for Immediate Delivery:

LATHES

15" x 6' Von Wyck.
16" x 6' Porter.
18" x 12' Blaisdell.
20" x 10' Fifield.
24" x 8' Sherman.
36" x 16' Fifield.

TURRET LATHES and SCREW MACHINES

Pratt & Whitney No. 1 Screw Mach.
Garvin 1/2" Screw Machine.
Pearson 1 1/8" Screw Machine.
Cleveland 1" Automatic (6).
Cleveland 1 1/2" Automatic.
Cleveland 2 1/2" Automatic (2).
Acme 7/8" Automatic.
Lodge & Davis 18" Monitor.
Gisholt 24" Manufacturers' Turret.

PLANERS AND SHAPERS

36" x 36" x 8' American, 2 heads.
36" x 35" x 15' Powell, 2 heads.
14" Gould & Eberhardt Crank.
15" Hendey Tool Room.
16" Stockbridge Crank P.D.F.
21" Averbeck B.G. Crank.

DRILL PRESSES

20" Miscellaneous Makes (20).
21" Cincinnati (2).
22 1/2" Barnes.
26" Sibley & Ware.
28" Barnes.
28" Sibley & Ware.
31" Barnes.
Avey 2-spindle ball-bearing.
Bausch No. 10, 16" Cluster.
Andrews 6-spindle, adjustable.
Bickford 3 1/2' Plain Radial.
Prentice 5' Plain Radial.

MILLING MACHINES

No. 3 Fox Hand and Power.
No. 0 LeBlond, plain.
No. 2 Owen, plain.
No. 3 Pratt & Whitney, plain.
No. 3-A Owen Universal.
No. 4 Becker Vertical.
Becker No. 7 Lincoln.
Phoenix No. 1 Lincoln.

PRESSES

Bliss No. 18 o.b.i.
Bliss No. 19 o.b.i.
Bliss No. 42 o.b.i
Rockford No. 2 o.b.i.
American Can No. 3 o.b.i.
Walsh No. 4 o.b.i.
American Can. No. 4 1/2 o.b.i.
Bauroth No. 5 o.b.i.
Bliss No. 69-N Double Acting.
Adriance No. 12-A Double Acting.
Toledo No. 14 Horning.
Toledo No. 94-A Double Crank.

MISCELLANEOUS

Bullard 42" Boring Mill.
Newark No. 2-A Auto Gear Cutter.
Landis 12 x 42" Plain Grinder.
Gisholt Universal Tool Room Grinder.
Acme 1 1/2" Bolt Cutter.
Acme 2 1/2" Bolt Cutter.
No. 2 and No. 3 M. & M. Keyseaters.
No. 3 Baker Keyseater with rotary table.

tion, and exonerates everybody else in connection with it.

Personal

R. W. Hendry, of Hendry, Ltd., has been appointed managing director of the Halifax and Sheet Harbor Steamship Co., Halifax, N.S.

R. J. Cluff has resigned his position as general manager of Steel & Radiation, Ltd., Toronto, to engage in the manufacture of war munitions.

Geo. L. Williams, of Brampton, Ont., has taken over the management of a shoe factory in Toronto and left for that city last week to assume control.

Charles A. Murton has been appointed sole representative in Hamilton, Ont., of the Ahern Safe Co., Montreal, the well-known makers of fire-proof safes, vault doors, etc.

Hon. Finlay McDiarmid, Minister of Public Works, and Hon. I. B. Lucas, Attorney General for Ontario, who have been touring Western Canada, have returned to Toronto.

John L. Feeney, of Fredericton, N.B., has been appointed by the Provincial Government of New Brunswick to the position of road engineer in charge of all important highway improvements.

John Knox, treasurer of the Dominion Power & Transmission Co., died at his home, 15 Robinson street, Hamilton, Ont., on Aug. 31. The late Mr. Knox was born at Kilwinning, Ayrshire, Scotland, and came to this city 32 years ago.

Giles S. Ransom died at his late residence, 386 Indian Road, Toronto, Ont., on Aug. 31, at the age of 62. The late Mr. Ransom was born in Buffalo, N.Y., in 1853, where he received his education. About 40 years ago he came to Toronto, where he has resided ever since. For the past 27 years he had been president of the Toronto Furnace & Crematory Co.

Trade Gossip

Hespeler, Ont.—The employees of the R. Forbes Co. have raised $750 towards the purchase of a machine gun.

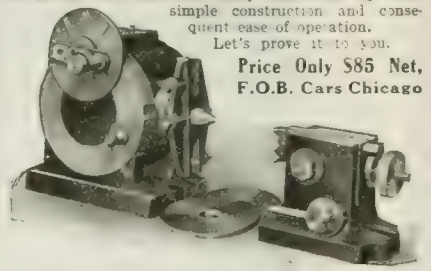
The Dominion Canners, Ltd., whose head office is at Hamilton, Ont., have taken over the British-Canadian Canning Co.

The North Bay Iron Works, of North Bay, Ont., have secured a contract from the Sturgeon Falls Pulp & Paper Co. to supply all castings and machine work for a year. The contract will amount to at least $25,000.

Save $40 to $90 on First Cost With Dickow's 10-Inch Universal Index Centers

We are originators of design. You save from $40 to $90 on first cost, and many times that by their simple construction and consequent ease of operation. Let's prove it to you.

Price Only $85 Net, F.O.B. Cars Chicago



Get the Original—Accuracy Guaranteed

Sold by all dealers. Write to-day for particulars

Fred. C. Dickow, 37 So. Desplaines St., Chicago, Ill., U.S.A

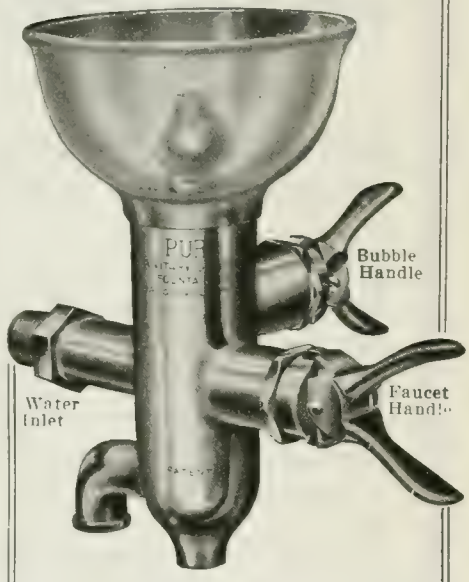
PURO

(MADE IN CANADA)

Saves Dollars

Why let that old-fashioned faucet go on year after year wasting water—MONEY?

Why more drinking cups and glasses only to become unsanitary—lost, broken or carried away? Puro Sanitary Drinking Fountain stops all this needless waste. Puro saves you 35% on the water bill alone. Puro saves you all that money you spend for cups. YET PURO is always ready with a clear, cool drink with dollars in the bank.



Puro Pays for Itself

You don't have to wait years to get back the small investment you have to make in Puro equipment.

You start cashing in at once—not only in your water bill saving, but on the increased efficiency of your workers as well.

Men like PURO—it's clean. No danger of deadly germs lurking in its sparkling bubble. Write us—tell how many men how many departments—and we'll tell you how much the cost will be to

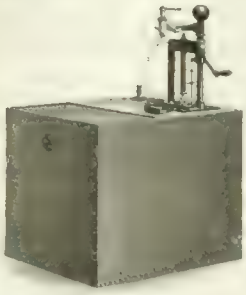
"PURO-FY"

YOUR WATER SUPPLY

Puro Sanitary Drinking Fountain Company

147 University Ave., Toronto, Canada

Shell Varnishing Equipment



For the manufacture of Lyddite Shells you can have in the Bowser Shell Varnishing Equipment a fixture that will enable you to varnish the shells with greater speed than by any other method.

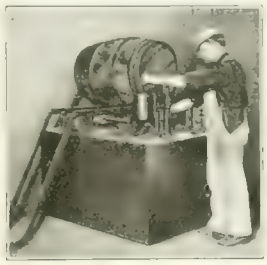
Time and Materials Saved

The pump exactly fills the shells without overflow. No varnish on the outside—no useless labor—no loss of time or materials.

BOWSER ESTABLISHED 1885 STANDARD THE WORLD OVER

Safe Storage Systems

We manufacture Oil Handling Devices for all conditions and oils. Full information will be furnished upon request.



Awarded Highest Honors—Grand Prize and Gold Medal—at Panama-Pacific International Exposition,—San Francisco, Cal., U. S. A. 1915.

Made in Canadian Works by Canadian Workmen and Sold by Canadian Salesmen.

BOWSER MADE IN CANADA

S. F. Bowser & Co.,
66-68 Frazer Avenue
Toronto, Ontario, Can.
Sales Offices in all Centers and Representatives Everywhere

ECONOMIC WATER OIL

SHELL MANUFACTURERS use ECONOMIC WATER OIL for METAL CUTTING of every description; it will not gum nor rust, and it SAVES TIME AND LABOR.

WE CAN SAVE YOU 50% in the **COST** of your **CUTTING MIXTURE** BECAUSE

ONE GALLON of ECONOMIC WATER OIL will mix readily with **30 to 50** gallons of WATER, making a thick, creamy emulsion, and giving you a cutting mixture which will not only be **satisfactory**, but will produce very **ECONOMIC RESULTS.**

Our TRIAL ORDER will **prove** our STATEMENT

Made in Canada

Canadian Economic Lubricant Co.
LIMITED
1040-1042 Durocher St. MONTREAL

Our Newly Designed

Shrapnel Shell Cleaning Machine

Cleans all *Standard* Sizes and accommodates various *other* sizes

The table of this machine has six shell pockets. Three of these are in the Blasting Department, and the other three, as shown in the illustration, are in the open. Thus, while three of the shells are being cleaned, the operator can remove the other three that have been cleaned, replacing them with three more to be blasted.

Consequently the machine can be kept in constant operation.

This machine, if connected to any exhaust system, will be nearly dustless and absolutely automatic in operation.

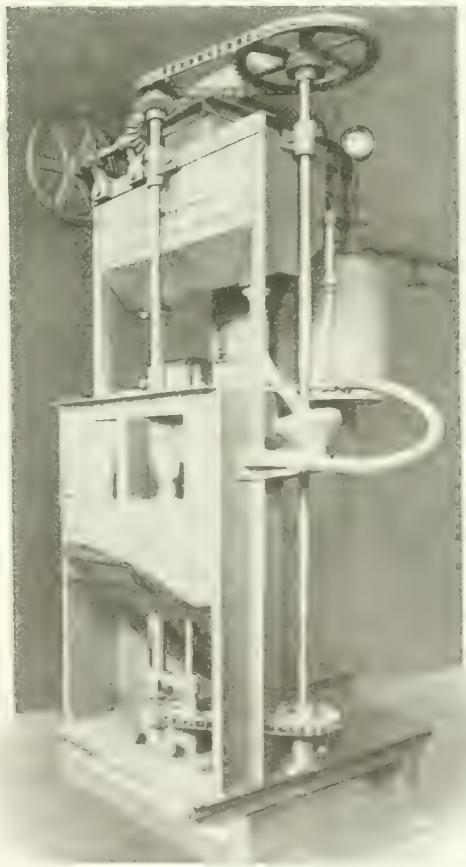
On the sand blasting table proper the division plates are lined with wood. This protects the steel plate. The wood is inexpensive and easily replaced.

The machine is so designed that the copper band groove is blasted on the exterior of the shell and another nozzle blasts the upper part of the exterior of the shell.

Its capacity for continuous running is from 150 to 200 shells per hour.

We are anxious to tell you all about it.

Write us.



We are manufacturers of Sand Blast equipment for any purpose used, also tumbling mills, dust arresters, cinder mills, resin grinders and other foundry equipment.

The W. W. SLY MANUFACTURING COMPANY
CLEVELAND OHIO

NOTICE

Having purchased the entire shop equipment of the W. S. Nott Fire Engine Company, 1620 Central Ave., Minneapolis, Minn., we offer, subject to prior sale, f.o.b. Minneapolis, the following machines:

1—36" x 16' American geared head, single pulley, heavy duty Lathe, Q. C. G., very little used.
1—24" x 12' Schumacher & Boye Lathe, D. B. G.
1—24" x 10' LeBlond Lathe.
1—20" x 12' Barker & Chard Lathe.
1—18" x 10' Hamilton Lathe.
1—18" x 8' Greaves & Klusman Lathe.
3—16" x 8' Hamilton Lathes.
1—16" x 6' Hamilton Lathe.
1—14" x 6' Hamilton Lathe.
1—No. 5 LeBlond Heavy Duty Plain D. B. G. Miller.
1—No. 3 Cincinnati Universal Miller.
1—51" Niles Vertical Boring Mill—nearly new.
1—No. 2½ Universal Horizontal Boring, Drilling and Milling Machine with aux. table and 14 bars, in fine condition.
1—No. 4 Landis Universal Grinder, complete with extra centers and 10⅜" Walker Circular Magnetic Chuck fitted, A1 condition.
1—No. 1 Cincinnati Universal Cutter and Tool Grinder.
1—American Twist Drill Grinder.
1—Dresses 6' Universal Radial Drill.
2—28" Drills.
2—24" Drills.
1—22" Drill.
3—20" Drills.
1—30" x 30" x 8' Cincinnati Planer.
1—24" Hamilton heavy duty B. G. Shaper.
1—16" Barker B. G. Shaper.
1—2" x 24" Jones & Lamson cone head Flat Turret Lathe—bar outfit.
1—No. 3 Dresses Universal Fox Monitor Lathe, with large assortment of attachments.
1—1½" Plurality Bolt Cutter with bolt and pipe dies.
1—No. 4 Besley Disc Grinder with floor press and four 18" steel discs.
1—No. 3 Burr Cold Saw Cutting-off Machine.
1—No. 14½ W. & W. Single End Punch and Shear, 18" throat.
1—500-lb. Ball Steam Hammer.
1—100-lb. Pittsburgh Steam Tool Dressing Hammer.
1—Type C, size 5 Pangborn Sand Blast Machine—serial No. 1257—good as new.

Also many other smaller Machines, Belting, Small Tools, Pneumatic Tools, Electric Drills and Grinders.

Our representative will be at plant until Sept. 22nd and we invite inspection.

The H. A. Stocker Machinery Co.

572 W. Randolph Street
CHICAGO, ILL.

The Northern Canada Power Co. have decided to increase their plant in Porcupine to an extent that will cost them at least one million dollars.

The A. B. Jardine Co., Hespeler, Ont., have sent a cheque for $300 to the local machine gun fund on behalf of the company and employees.

Munitions Manufacture.—It is reported that 10,000 brass cartridge cases for shrapnel shells are being turned out ea h day in the Montreal district.

Customs Notice. — Steam towing winches are now manufactured in Canada by the Corbet Foundry & Machine Co., of Owen Sound, Ont., and are, therefore, not entitled to entry under tariff item No. 470.

The Process Engineers, Ltd., of Montreal, Que., have leased for three years the antimony mines owned by the Canadian Antimony Co. at Lake George, York County, N.B., about 25 miles from Fredericton, and operations will be commenced immediately.

The Imperial Oil Co., Toronto, announce that married men among the employees of the corporation who have enlisted or may enlist for active service overseas will receive half pay and single men quarter pay until the end of the war. In addition, the company will hold the men's positions open for them on their return.

Montreal, Que.—A comprehensive scheme is on foot to erect a large exhibition building or "Palace of Industry" for the holding of trade exhibitions in the Montreal area, and in particular for a large industrial fair in the spring of 1917, according to a statement by T. C. Kirby, manager of the Montreal Automobile Trade Association, Ltd.

Ontario Nickel Commission. — The chairman of the new Ontario Nickel Commission, George T. Holloway, London, Eng., has arrived in Canada and has already met his colleagues, Prof. Miller, Provincial Geologist; T. W. Gibson, Deputy Minister of Mines, and Macgregor Young, K.C. The first steps of the Commission will be a thorough examination of the Sudbury nickel industry, to be followed by a visit to the big New Jersey refining plants, where most of Ontario's nickel ore is treated. One of the Commission's duties will be to prepare an estimate of the extent of Ontario's nickel ore bodies, which would be necessary as a basis for permanent taxation policy.

Collingwood Shipbuilding Co.—The annual general meeting of the Collingwood Shipbuilding Co. was held on Sept. 1. The usual financial statements and balance sheets were presented and we under-

PATENTS PROMPTLY SECURED

In all countries. Ask for our **Inventor's Adviser**, which will be **sent free.**

MARION & MARION, 364 University St.

Merchants Bank Building, corner St. Catherine St., MONTREAL, Phone Up 6474 and Washington, D.C., U.S.A.

COLD ROLLED STEEL STRIPS

For stamping of all kinds. All tempers. All carbons.

EXTRA BRIGHT FINISH

Prompt Shipments from Mill.

A. C. LESLIE & CO.
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26" Draper Turret Lathe, 1½" hole.
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[illegible]" Hartford Automatics (2).

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Whitney Hand Millers (13).
No. 3 Fox Hand and Power Millers (2).
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No. 9 Kempsmith, plain.
No. 6 Grant Manufacturing Miller.

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A. D. White Machinery Co.
108-114 N. Jefferson St., CHICAGO

stand were of a satisfactory character, considering the dull period of the first half of the company's year. The following were elected directors: Thos. Long, Toronto; Capt. Alex. McDougall, Duluth; S. H. Lindsay, Collingwood; P. M. Campbell, Collingwood; H. B. Smith, Owen Sound; S. Dyment, Barrie; M. P. Byrnes, Collingwood; T. P. Long, Collingwood. At a subsequent meeting of the directors, the following officers were elected: President, Thos. Long; Vice-President, Capt. Alex. McDougall; Secretary-Treasurer, S. H. Lindsay.

Heavy Exports Anticipated.—Inquiry of shipping companies brings responses to the effect that there is a big demand for grain for all periods from now to the close of navigation, and that this demand extends to all other classes of cargo as well. That is to say, large quantities are demanded of flour, cheese, deals, and provisions, as well as of manufactured articles of every description. One feature in the export trade, which of itself makes this a remarkable year as compared with all past ones in the history of the port of Montreal, is the export of large quantities of steel in billets, tubes, bars and all kinds of shapes. In previous years it has been rather a case of importing such articles than exporting them. Apples will also commence to move freely about the middle of September. With these cargoes in prospect the various steamship lines look for a very heavy export business this fall.

Catalogues

"Burd" Piston Rings.—Bulletin describing the "Burd" high compression rings, made by the Burd High Compression Ring Co., Rockford, Ill. The principal features of this ring are dealt with at length, accompanied by illustrations showing the general construction.

Machinists' Tools.—The National Machinery and Supply Co., Hamilton, Ont., have issued a new catalogue dealing with machinist and woodworker tools, such as vises, planes, handscrews, clamps, etc. The catalogue is fully illustrated and prices are included for each product.

Dixon's Graphite Brushes is the title of a booklet, which explains how the characteristic lubricating qualities of graphite are utilized for reducing commutator troubles to a minimum. The entire booklet is recommended for careful consideration, especially page 3, where the advantages of graphite are clearly set forth. A copy of the booklet may be obtained free upon request from the Joseph Dixon Crucible Co., Jersey City, N.J.

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OFFICE AND WORKS: MUSKEGON HEIGHTS U.S.A.

A Chain of Evidence is the title of a publication, No. 13, recently issued by the Morse Chain Co., Ithaca, N.Y., illustrating and describing the "Morse" silent chain and showing a few applications in textile mills. The illustration shows several "Morse" chain drives, each being accompanied by particulars of the drive.

Steel Sheet Piling.—Bulletin No. 108 describes fully arched web, straight web, centre flange protected and plate types of steel sheet piling made by the Lackawanna Steel Co., Lackawanna, N.Y. A number of excellent half-tones show many interesting installations featuring the wide scope of this product. Cross sections are shown of the various types, together with weights and dimensions, while an efficiency table is also included. A brief description accompanies each illustration explaining the principal features of the work shown in the view. The catalogue contains much interesting and useful information on steel piling and its application. The general agents for Canada are the H. A. Drury Co., Ltd., Montreal, Que.

THE PROPRIETORS OF LETTERS PATENT No. 144,377, relating to "Method of and apparatus for manufacturing sinking weights for fishing tackle," desire to dispose of the patent or to grant licence to interested parties at reasonable terms, with a view to the adequate working of the patent in Canada. Inquiries to be addressed to the actual proprietors, Jon Paulssons Fiskredskapsfabrik, Delsbo, Sweden.

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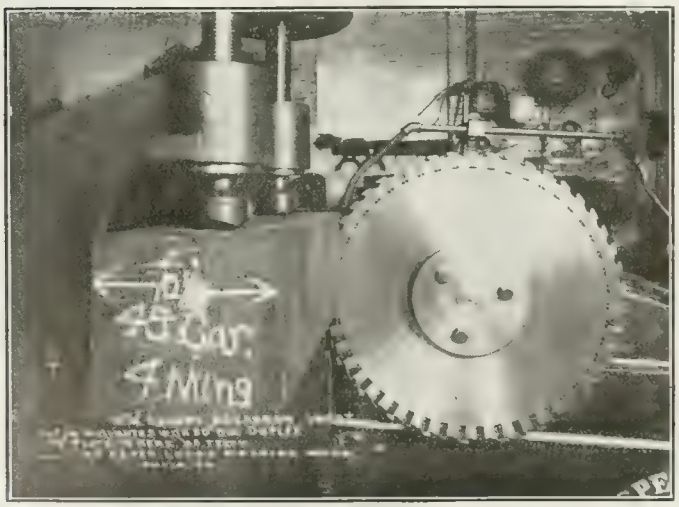

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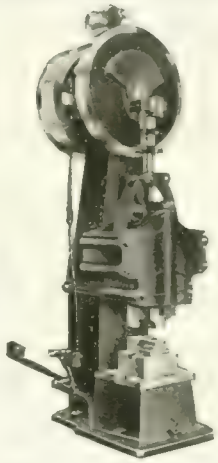

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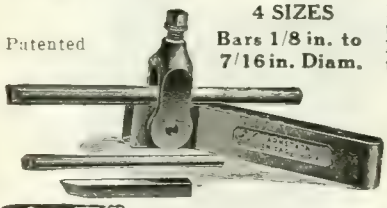

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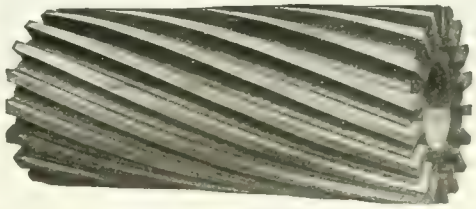

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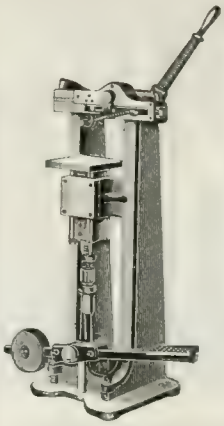

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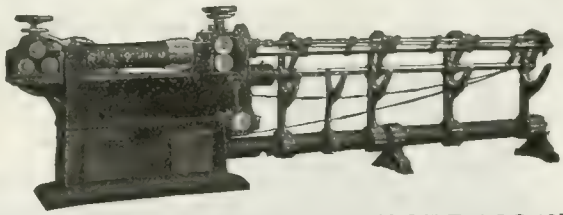

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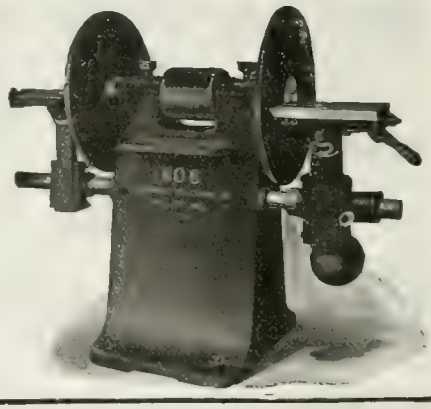

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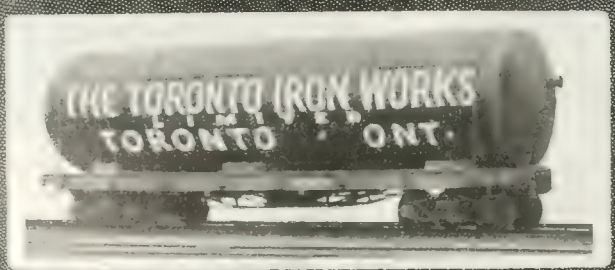

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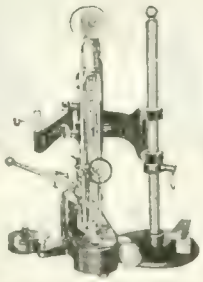

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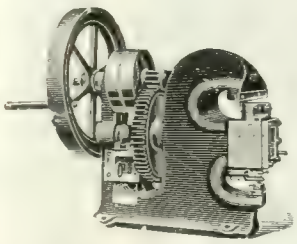

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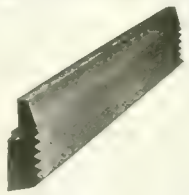

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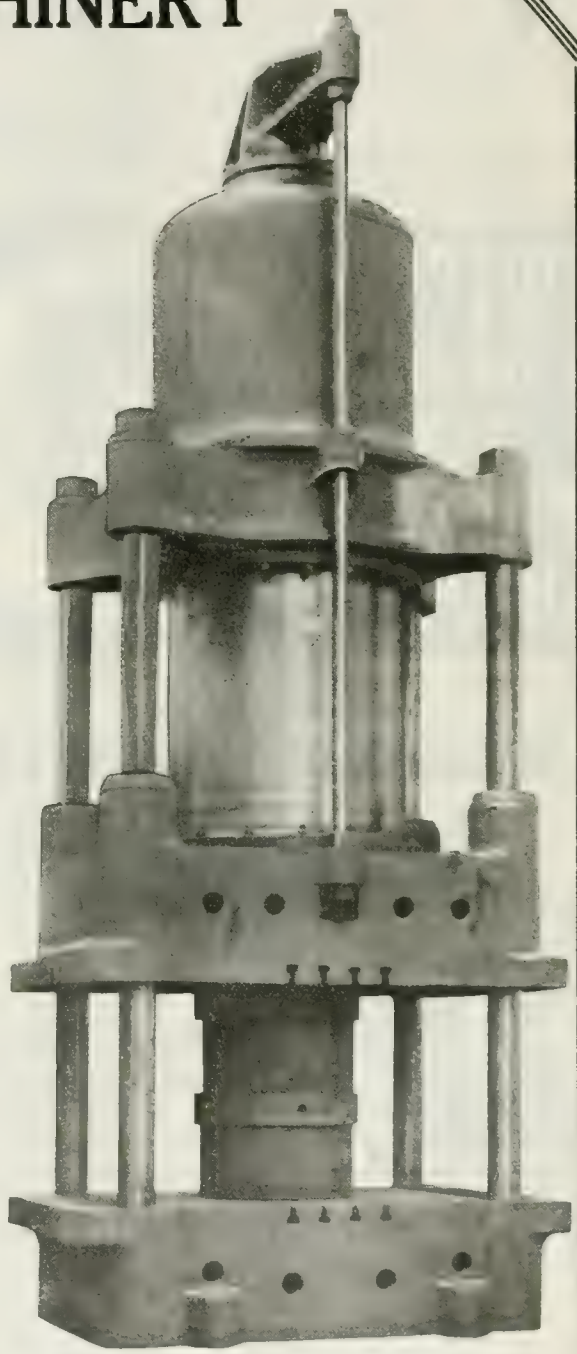

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Belting, Leather.
Can. Fairbanks-Morse Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Graton & Knight Mfg. Co., Montreal.
Main Belting Co., Montreal.
Morse Chain Co., Ithaca, N.Y.
D. K. McLaren, Ltd., Montreal.
F. Reddaway & Co., Montreal.

Belting, Stitched Cotton Duck.
Dominion Belting Co., Hamilton, Ont.
Main Belting Co., Montreal.

Belting, Rubber.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Benders, Angle and Tee Iron.
Can. Buffalo Forge Co., Montreal.
Watson-Stillman Co., Aldene, N.J.

Bending Machinery.
John Bertram & Sons Co., Dundas.
Bertrams, Limited, Edinburgh, Scotland.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Can. Buffalo Forge Co., Montreal.
Can. Machinery Corporation, Galt, Ont.
Charles F. Elmes Eng. Works, Chicago
Jardine, A. B., & Co., Hespeler, Ont.
National Machinery Co., Tiffin, Ohio.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Owen Sound Iron Works Co., Owen Sound.
Toledo Machine & Tool Co., Toledo, O.
Steel Bending Brake Works, Chatham, Ont.
Watson-Stillman Co., Aldene, N.J.

Bins, Steel.
Dennis Wire & Iron Works Co., Ltd., London, Canada.
Toronto Iron Works, Ltd., Toronto.

Bit Brace Tools.
Wells Bros. Co., Greenfield, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Blast Gauges, Cupola.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Blocks, Lifting.
Northern Crane Works, Walkerville.

Blowers.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Girard Machine & Tool Co., Philadelphia, Pa.
Sheldons, Ltd., Galt, Ont.
Southwark Foundry & Machine Co., Philadelphia.

Blow Pipes and Regulators.
L'Air Liquide Society, Montreal, Toronto.
Lever Bros., Toronto.

Bluing Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Boilers.
Can. Locomotive Co., Kingston, Ont.
National Machinery & Supply Co., Hamilton.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.

Boiler Compounds.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Boiler Graphite.
Dixon Crucible Co., Jersey City, N.J.

Boiler Makers' Supplies.
Jno. F. Allen Co., New York.

Bolt Cutters and Nut Tapers.
Wells Brothers Co., Greenfield, Mass.

Bolts.
Galt Machine Screw Co., Galt, Ont.
London Bolt & Hinge Works, London, Ont.

Bolt and Nut Machinery.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas, Ont.
Owen Sound Iron Works Co., Owen Sound.
Gardner, Robt., & Son, Montreal.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, O.
National Machinery & Supply Co., Hamilton.
Wiley & Russell Co., Greenfield, Mass.

Books.
MacLean Publishing Co., Toronto.

Boring Machines, Upright and Horizontal.
John Bertram & Sons Co., Dundas.
Can. Machinery Corporation, Galt, Ont.
Colburn Machine Tool Co., Franklin, Pa.
Girard Machine & Tool Co., Philadelphia, Pa.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.
National Machinery & Supply Co., Hamilton.
Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement Pond Co., New York.
Stow Mfg. Co., Binghamton, N.Y.

Boring Machines, Pneumatic, Cylinder.
Baker Brothers, Toledo, O.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Independent Pneumatic Tool Co., Chicago, Ill.
Newton Machine Tool Works, Philadelphia, Pa.
Stow Mfg. Co., Binghamton, N.Y.

Boring and Turning Mills.
John Bertram & Sons Co., Dundas.
Colburn Machine Tool Co., Franklin, Pa.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.

Boxes, Annealing, Charging.
Mesta Machine Co., Pittsburg, Pa.

Box Puller.
Jardine, A. B., & Co., Hespeler, Ont.

Boxes, Steel Shop.
Cleveland Wire Spring Co., Cleveland.

Boxes, Tote.
Cleveland Wire Spring Co., Cleveland.

Brakes.
Brown, Boggs & Co., Hamilton, Can.
Whiting Foundry Equipment Co., Harvey, Ill.

Brakes, Heavy Plate Bending and Cornice.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Brass Working Machinery.
A. R. Williams Machy. Co., Toronto.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Warner & Swasey Co., Cleveland.
Niles-Bement-Pond Co., New York.

Brick Cars.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Brick Dryers.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Ltd., Galt, Ont.

Brick Machinery.
Eastern Machinery Co., New Haven.
Sheldons, Ltd., Galt, Ont.

Bridges, Railway and Highway.
Can. Bridge Co., Walkerville, Ont.

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Whiting Foundry Equipment Co., Harvey, Ill.

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Ford-Smith Machine Co., Hamilton, Ont.
Girard Machine & Tool Co., Philadelphia, Pa.
Gray Mfg. & Machine Co., Toronto.
New Britain Machine Co. New Britain, Conn.

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John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brooklyn, N.Y.
Canada Mach. Corporation, Galt, Ont.
National Machinery & Supply Co., Hamilton, Ont.
Watson-Stillman Co., Aldene, N.J.

Burners, Enclosed Flame Gas.
Oven Equipment & Mfg. Co., New Haven, Conn.

Burners, Fuel, Oil and Natural Gas.
Whiting Foundry Equipment Co., Harvey, Ill.

Burring Reamers.
Wells Brothers Company, Greenfield, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Butteries.
Wells Brothers Company, Greenfield, Mass.

Burrs, Iron and Copper.
Parmenter & Bulloch Co., Gananoque.

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Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
National Machinery & Supply Co., Hamilton, Ont.

Caissons.
Toronto Iron Works Ltd., Toronto.

Cars, Charging Box Ingot.
Mesta Machine Co., Pittsburg, Pa.

Cars, Industrial.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Limited, Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Castings, Aluminum.
Cunningham & Son, St. Catharines, Ont.
Owen Sound Iron Works Co., Ltd., Owen Sound, Ont.
St. Lawrence Foundry, Galt, Ont.
Tallman Brass & Metal Co., Hamilton

Castings, Air Furnaces.
Wm. Tod Company, Youngstown, O.

Castings, Brass.
Cunningham & Son, St. Catharines, Ont.
Alexander Fleck, Ltd., Ottawa.
T. C. Lawrence Foundry, Galt, Ont.
Mesta Machine Co., Pittsburg, Pa.
Owen Sound Iron Works Co., Owen Sound.
Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa.
Plessisville Foundry, Plessisville, Que.
Tallman Brass & Metal Co., Hamilton
Wm. Tod Company, Youngstown, O.

Castings, Bronze.
Cunningham & Son, St. Catharines, Ont.
Mesta Machine Co., Pittsburg, Pa.
Tallman Brass & Metal Co., Hamilton
Wm. Tod Company, Youngstown, O.

Castings, Copper.
Cunningham & Son, St. Catharines, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Castings, Gray Iron.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Erie Foundry Co., Erie, Pa.
Alexander Fleck, Ltd., Ottawa.
Gardner, Robt., & Son, Montreal.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Mesta Machine Co., Pittsburg, Pa.
Owen Sound Iron Works Co., Owen Sound.
Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa.
Plessisville Foundry, Plessisville, Que.
Wm. Tod Company, Youngstown, O.

Castings, Steel Chrome and Manganese Steel.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Mesta Machine Co., Pittsburg, Pa.
Wm. Tod Company, Youngstown, O.

Castings, Malleable.
Galt Malleable Iron Co., Galt.

Castings, Nickel Steel.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Mesta Machine Co., Pittsburg, Pa.

Cement, Disc Wheel.
Gardner Machine Co., Beloit, Wis.

Cement, Iron.
Can. H. W. Johns-Manville Co., Limited, Toronto.
Shelton Metallic Filler Co., Derby, O.

Cement Machinery.
Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt., & Son, Montreal.
National Machinery & Supply Co., Hamilton, Ont.
Owen Sound Iron Works Co., Owen Sound.

Centre Reamers.
Wells Brothers Co., Greenfield, Mass.

Centering Machines.
John Bertram & Sons Co., Dundas.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.

Centrifugal Pumps.
Can. Buffalo Forge Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Smart-Turner Machine Co., Hamilton, Ont.

Chain Blocks.
Can. Fairbanks-Morse Co., Montreal.
National Machinery & Supply Co., Hamilton.

Chains, Silent and Transmission.
Jones & Glasseo, Montreal.
Morse Chain Co., Ithaca, N.Y.
Plessisville Foundry, Plessisville, Que.

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Toronto Testing Laboratory, Ltd., Toronto.

Chucks, Aero, Automatic.
Garvin Machine Co., New York.

Chucks, Drill, Lathe and Universal.
John Bertram & Sons Co., Dundas, Ont.
Buffalo Forge Co., Buffalo, N.Y.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Cushman Chuck Co., Hartford, Conn.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Wells Brothers Co., Greenfield, Mass.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin, Brantford.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Machinery & Supply Co., Hamilton.
Skinner Chuck Co., New Britain, Conn.
D. E. Whiton Machine Co., New London, Conn.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Chucks, Drill, Automatic and Keyless.
Buffalo Forge Co., Buffalo, N.Y.

Chucks, Ring Wheel.
Gardner Machine Co., Beloit, Wis.

Chucking Machines.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
New Britain Machine Co., New Britain, Conn.
Niles-Bement-Pond Co., New York.
Turner Machine Co., Danbury, Conn.
Warner & Swasey Co., Cleveland, O.

Clocks, Time and Watchman's.
Lintz-Porter Co., Toronto.

Cloth and Wool Dryers.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Sheldons, Limited, Galt.

Clutches.
Eastern Machinery Co., New Haven, Conn.
Jones & Glasseo, Montreal.
Owen Sound Iron Works Co., Owen Sound.
Positive Clutch & Pulley Works, Ltd., Toronto.

Coal Handling Machinery.
Whiting Foundry Equipment Co., Harvey, Ill.

Coke and Coal.
Hanna & Co., M. A., Cleveland, O.

Collectors. Pneumatic.
Can. Buffalo Forge Co., Montreal.
Sheldons, Limited, Galt.

Compressors, Air.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.
Mesta Machine Co., Pittsburg, Pa.
National Machinery & Supply Co., Hamilton.
Southwark Foundry & Machine Co., Philadelphia, Pa.
The Smart-Turner Machine Co., Hamilton.

Concentrating Plant.
Gardner, Robt., & Son, Montreal.

Concrete Mixers.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
National Machinery & Supply Co., Hamilton.

Concrete Reinforcement.
Canada Wire Goods Mfg. Co., Hamilton.

Condensers.
Can. Buffalo Forge Co., Montreal.
Mesta Machine Co., Pittsburg, Pa.
The Smart-Turner Machine Co., Hamilton.
Southwark Foundry & Machine Co., Philadelphia.
Wm. Tod Company, Youngstown, O.

Contracting Engineers, Electrical
Lintz-Porter Co., Toronto.

Controllers and Starters, Electric Motor.
A. R. Williams Machy. Co., Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Conveyor Machinery.
Can. Fairbanks-Morse Co., Montreal.
Can. Mathews Gravity Carrier Co., Toronto.
National Machinery & Supply Co., Hamilton, Ont.
Plessisville Foundry, Plessisville, Que.
The Smart-Turner Machine Co., Hamilton.

Coping Machines.
Can. Buffalo Forge Co., Montreal.
John Bertram & Sons Co., Dundas.
National Machinery & Supply Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Cornice Brakes.
Brown Boggs Co., Ltd., Hamilton, Canada.
Steel Bending Brake Wks., Chatham.

Counting Machines.
National Scale Co., Chicopee Falls, Mass.
C. J. Root Co., Bristol, Conn.

Counterbores and Countersinks.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., Greenfield, Mass.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Countershafts.
Baird Machine Co., Bridgeport, Conn.
Wells Bros. Co., Greenfield, Mass.

Country House Lighting and Cooking.
Can. Blaugas Co., Montreal.

Couplings.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Eastern Machinery Co., New Haven, Conn.
Gardner, Robt., & Son, Montreal.
Owen Sound Iron Works Co., Owen Sound, Ont.

Couplings, Air Hose.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Crabs, Travelling.
Owen Sound Iron Works Co., Owen Sound.

Cranes, Locomotive.
Northern Crane Works, Walkerville.

Cranes, Gantry.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Goliath.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Hydraulic.
Watson-Stillman Co., Aldene, N.J.

Cranes, Pneumatic.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Post Jib.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Portable.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Swing Jib.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Transfer.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Wall.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Travelling Electric and Hand Power.
Dominion Bridge Co., Montreal.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Crane, Chain.
Northern Crane Works, Walkerville.

Cranes, All Kinds.
Northern Crane Works, Walkerville.
Owen Sound Iron Works Co., Owen Sound, Ont.
Southwork Foundry & Machine Co., Philadelphia.
Whiting Foundry Equipment Co., Harvey, Ill.

Crank Pin Turning Machine.
Niles-Bement-Pond Co., New York.

Crimps, Leather.
Graton & Knight Mfg. Co., Montreal.

Cupolas.
Can. Buffalo Forge Co., Montreal.
Northern Crane Works, Walkerville.
Sheldons, Ltd., Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cupola and Blast Gate Blowers.
Can. Sirocco Co., Ltd., Windsor, Ont.

Cupola Blast Gauges & Blowers.
Sheldons, Ltd., Galt, Ont.

Cutters, Angle, Tee Iron and Bar.
Can. Buffalo Forge Co., Montreal.

Cutters, Flue.
Independent Pneumatic Tool Co., Chicago.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Cutters, Pipe.
Can. Fairbanks-Morse Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Trimont Mfg. Co., Roxbury, Mass.

Cutting Compound & Cutting Oil.
Can. Economic Lubricant Co., Montreal.
Can. Oil Companies, Toronto.
Cataract Refining Co., Buffalo, N.Y.
Crescent Oil Co., New York.
Racine Tool & Machine Co., Racine, Wis.

Cutter Grinders and Attachments
Cincinnati Milling Machine Co., Cincinnati.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.

Cutters, Milling.
A. R. Williams Machy. Co., Toronto
Can. Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland.
Garvin Machine Co., New York.
Morse Twist Drill and Machine Co., New Bedford.
Tabor Mfg. Co., Philadelphia, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Cutting-off Machines.
Armstrong Bros. Tool Co., Chicago.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Espen-Lucas Machine Wks., Philadelphia, Pa.
Foss & Hill Machy. Co., Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Geo. Gorton Machine Co., Racine, Wis.
John H. Hall & Sons, Brantford, Ont.
Nutter & Barnes Co., Hinsdale, N.H.
Pratt & Whitney Co., Dundas, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
L. S. Starrett Co., Athol, Mass.

Damper Regulators.
Can. Fairbanks-Morse Co., Montreal.

Derricks.
Dominion Bridge Co., Montreal.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Designers, Special Machinery.
Baird Machine Co., Bridgeport, Conn.

Dies and Die Stocks.
Armstrong Mfg. Co., Bridgeport, Conn.
Banfield, W. H. & Son, Toronto.
Butterfield & Co., Rock Island, Que.
Brown, Boggs & Co., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Duncan Electrical Co., Montreal.
Gardner, Robt., & Son, Montreal.
Greenfield Tap & Die Corporation, Greenfield, Mass.
A. B. Jardine & Co., Hespeler, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wiley & Russell, Greenfield, Mass.

Dies for Bit Brace Use.
Wells Brothers Co., Greenfield, Mass.

Die Sinkers.
Garvin Machine Co., New York.

Dies for Machines.
Wells Brothers Co., Greenfield, Mass.

Die Sinking Presses, Hydraulic.
Charles F. Elmes Eng. Works, Chicago
Watson-Stillman Co., Aldene, N.J.

Dies, Self-opening.
Duncan Electrical Co., Montreal.
Geometric Tool Co., New Haven.
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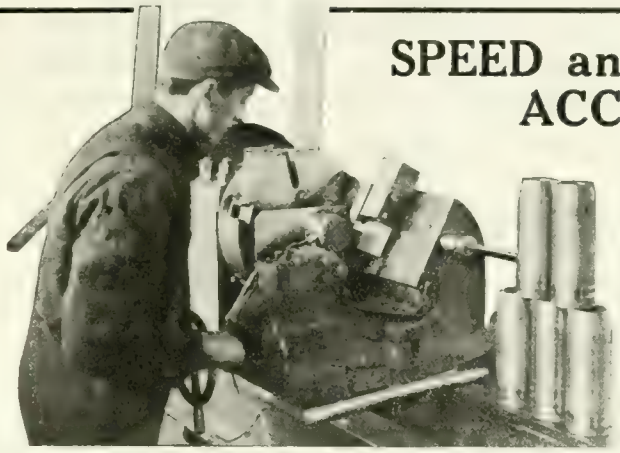

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Pratt & Whitney Co., Dundas, Ont.
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Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.

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Baker Bros., Toledo, O.
Barnes Drill Co., Rockford, Ill.
John Bertram & Sons Co., Dundas.
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Motch & Merryweather Machy. Co., Cleveland, O.
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Turner Machine Co., Danbury, Conn.

Drilling Machines, Sensitive.
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Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Rockford Machine Tool Co., Rockford.

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Baker Bros., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Colburn Mach. Tool Co., Franklin, Pa.
A. R. Williams Machy. Co., Toronto.
W. F. & John Barnes Co., Rockford.
John Bertram & Sons Co., Dundas.
Girard Machine & Tool Co., Philadelphia, Pa.
A. B. Jardine & Co., Hespeler, Ont.
Rockford Machine Tool Co., Rockford.
R. McDougall Co., Galt.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.

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W. F. & John Barnes Co., Rockford.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.
United States Electrical Tool Co., Cincinnati.

Drills, Blacksmith and Bit Stock.
Can. Buffalo Forge Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Drills, Centre.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill and Machine Co. New Bedford.
Pratt & Whitney Co., Dundas, Ont.
L. S. Starrett Co., Athol, Mass.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Drills Corner (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Drills, Electric and Portable.
A. R. Williams Machy. Co., Toronto.
Can. Buffalo Forge Co., Montreal.
Niles-Bement-Pond Co., New York.
Stow Mfg. Co., Binghamton, N.Y.
United States Electrical Tool Co., Cincinnati, O.

Drills, High Speed.
Baker Bros., Toledo, O.
Cleveland Twist Drill Co., Cleveland.
Can. Fairbanks-Morse Co., Montreal.
Morse Twist Drill and Machine Co., New Bedford.
W. F. & John Barnes Co., Rockford, Ill.
Pratt & Whitney Co., Dundas, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Drills, Multiple Spindle.
Pratt & Whitney Co., Dundas, Ont.
Niles-Bement-Pond Co., New York.

Drills, Oil Tube.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill and Machine Co. New Bedford.

Drills, Pneumatic.
John F. Allen Co., New York.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.

Drills, Ratchet and Hand.
Armstrong Bros. Tool Co., Chicago.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford.
National Forge & Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

Drills, Rock.
A. R. Williams Machy. Co., Toronto.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Drills, Track.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill and Machine Co., New Bedford.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drills, Twist.
Armstrong, Whitworth of Canada, Ltd., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
John Morrow Screw Co., Ingersoll, Ont.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drill Holders.
Wells Brothers Co., Greenfield, Mass.

Drill Sockets.
Modern Tool Co., Erie, Pa.
Morse Twist Drill and Machine Co., New Bedford.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drying Appliances.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Ltd., Galt, Ont.

Drying Out Barrels.
Baird Machine Co., Bridgeport, Conn.

Drying Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.
Whiting Foundry Equipment Co., Harvey, Ill.

Dump Cars.
Can. Fairbanks-Morse Co., Montreal.
National Machinery & Supply Co., Hamilton, Ont.
Owen Sound Iron Works Co., Owen Sound
Plessisville Foundry, Plessisville, Que.

Dust Separators.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Dust Arresters (for Tumbling Mills).
Whiting Foundry Equipment Co., Harvey, Ill.

Dynamos and Electrical Supplies.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Lancashire Dynamo and Motor Co., Ltd., Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Electrical Supplies.
Duncan Electrical Co., Montreal.
Lintz-Porter Co., Toronto.

Elevator Enclosures.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Elevating and Conveying Machinery.
Can. Mathews Gravity Co., Toronto.
Plessisville Foundry, Plessisville, Que.

Emery Grinders (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Stow Mfg. Co., Binghamton, N.Y.

Emery and Emery Wheels.
Can. Fairbanks-Morse Co., Montreal.
Canadian Hart Wheels, Hamilton, Ont.
Ford-Smith Machine Co., Hamilton.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.

Emery Wheels, Dressers and Stands.
Canadian Hart Wheels, Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
National Machinery & Supply Co. Hamilton, Ont.
Norton Co., Worcester, Mass.

Emery Wheel Safety Flanges.
Canadian Hart Wheels, Hamilton, Ont.

Enameling Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Engines, Corliss, Compound, Pumping.
Mesta Machine Co., Pittsburg, Pa.
Wm. Tod Company, Youngstown, O.

Engines, Gas and Gasoline.
Can. Fairbanks-Morse Co., Montreal.
Jones & Glassco. Montreal.
Mesta Machine Co., Pittsburg, Pa.
National Machinery & Supply Co., Hamilton.
Wm. Tod Company, Youngstown, O.

Engines, Horizontal and Vertical.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Mesta Machine Co., Pittsburg, Pa.
A. R. Williams Machy. Co., Toronto.
Sheldons, Ltd., Galt, Ont.
Wm. Tod Co., Youngstown, O.

Engines, High-Speed, Automatic.
Can. Buffalo Forge Co., Montreal.

Engines, Steam.
Can. Buffalo Forge Co., Montreal.
Mesta Machine Co., Pittsburg, Pa.
Plessisville Foundry, Plessisville, Que.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Wm. Tod Company, Youngstown, O.

Engines, Stationary and Marine.
Southwark Foundry & Machine Co., Philadelphia, Pa.

Engineering Books.
The MacLean Publishing Co., Ltd., Toronto.

Engraving Machines.
Geo. Gorton Machine Co., Racine, Wis.

Elevators and Buckets.
Eastern Machinery Co., New Haven, Conn.
Whiting Foundry Equipment Co., Harvey, Ill.

Equipment Shop.
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.
Wm. Tod Co., Youngstown, O.

Escutcheon Pins.
Parmenter & Bulloch Co., Gananoque.

Evaporators' Machinery.
Brown, Boggs & Co., Hamilton, Can.

Exhaust Heads and Hoods.
Can. Buffalo Forge Co., Montreal.
Can. Steel Products Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Exhausters.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.

Experimental Machinery.
Owen Sound Iron Works Co., Owen Sound.

Extractors, Ingot.
Mesta Machine Co., Pittsburg, Pa.

Fans.
Can. Buffalo Forge Co., Berlin, Ont.
Baird Machine Co., Bridgeport, Conn.
Can. Sirocco Co., Ltd., Windsor, Ont.
Lintz Porter Co., Toronto.
Plessisville Foundry, Plessisville, Que.
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton.

Feed Water Heaters.
Can. Fairbanks-Morse Co., Montreal.
The Smart-Turner Machine Co., Hamilton.

Fence, Iron Factory.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.
Standard Tube & Fence Co., Woodstock, Ont.

Files.
Delta File Works, Philadelphia, Pa.
Nicholson File Co., Port Hope, Ont.

Fire Alarm Apparatus.
Lintz-Porter Co., Toronto.

Fire Extinguishers.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Fire Escapes.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Flash Lamps.
Lintz-Porter Co., Toronto.

Flexible Shafts.
Chicago Flexible Shaft Co., Chicago, Ill.
Stow Mfg. Co., Binghamton, N.Y.

Flumes.
Toronto Iron Works, Ltd., Toronto.

Forges, Hand, etc.
Can. Buffalo Forge Co., Montreal.
Independent Pneumatic Tool Co., Chicago, Ill.
National Machinery & Supply Co., Hamilton.
Sheldons, Limited, Galt, Ont.

Forgings, Drop, Automobile and Locomotive.
Bliss, E. W., Co., Brooklyn, N.Y.
Canadian Billings & Spencer, Ltd. Welland.
Mesta Machine Co., Pittsburg, Pa.
Ready Tool Co., Bridgeport, Conn.
J. H. Williams Co., Brooklyn, N.Y.

Forging Hammers, Belt-Driven.
Bliss, E. W., Co., Brooklyn, N.Y.
Plessisville Foundry, Plessisville, Que.

Forging Hammers, Steam.
Erie Foundry Co., Erie, Pa.

Forging Machinery.
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton Canada.
National Machinery Co., Tiffin, Ohio.
Plessisville Foundry, Plessisville, Que.
Wm. Tod Company, Youngstown, O.
Watson-Stillman Co., Aldene, N.J.

Foundry Equipment.
Northern Crane Works, Walkerville.
W. W. Sly Mfg. Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

Friction Leathers.
Graton & Knight Mfg. Co., Montreal.

Friction Clutch Pulleys, etc
American Pulley Co., Philadelphia, Pa.
Baird Machine Co., Bridgeport, Conn.
Eastern Machinery Co., New Haven, Conn.
D. K. McLaren, Ltd., Montreal.
Owen Sound Iron Works Co., Owen Sound.
Positive Clutch & Pulley Works, Toronto.

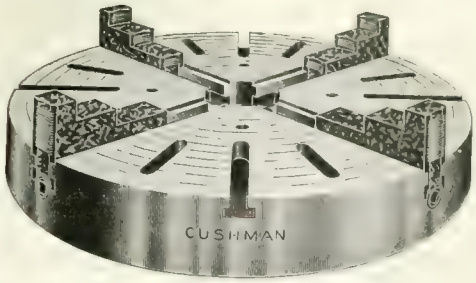
Furnace Engineers and Contractors.
Whiting Foundry Equipment Co. Harvey, Ill.

Furnaces, Blast.
Toronto Iron Works, Ltd., Toronto.

Furnaces, Oil, Coal, Gas and Electric.
Canadian Hoskins, Limited, Walkerville, Ont.
Chicago Flexible Shaft Co., Chicago Ill.
Mechanical Engineering Co., 55 Cote St., Montreal, Que.
Tate, Jones & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Steel Heating and Brass Melting.
Can. Hoskins, Ltd., Walkerville, Ont.
Chicago Flexible Shaft Co., Chicago Ill.
Mechanical Engineering Co., 55 Cote St., Montreal, Que.
Tate, Jones & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Cushman Chucks



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Lathe Chucks, Drill Chucks, Centering Chucks, Portable Face Plate Jaws

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Let us send you our catalog.

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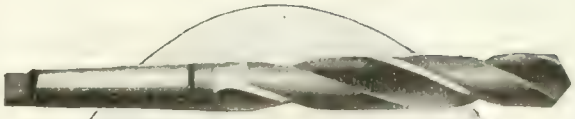
Hartford, Conn., U.S.A.



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Tests in some of the largest shops in this country prove conclusively that Cleveland Twist Drills produce the greatest number of holes per money invested in drills.

Read up on Hole Production. Ask for "Drill Chips" to come monthly.

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New York CLEVELAND, U. S. A. Chicago

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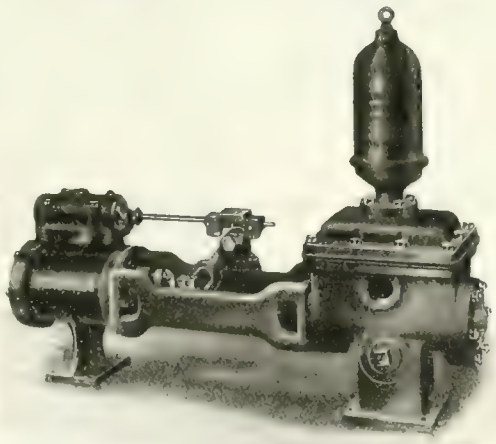
Of the thousands of steam pumps installed every year, a large percentage of them bear the name of "Burnham," the *Steam Pump* endorsed by leading Architects, Consulting Engineers and Heating Contractors as the best, simplest and most economical pump on the market.

If you want a pump for handling hot water, use the "Burnham."



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Thousands of Burnham pumps are in operation in connection with *Vacuum Heating Systems;* they are specially adapted for this service. Standard Burnham Boiler Feed Pumps and Burnham Vacuum Pumps are kept in stock and can be shipped promptly.

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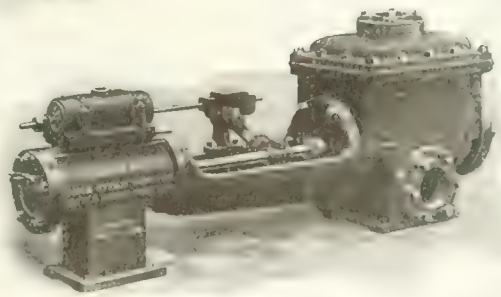

Burnham Vacuum Pump

Furnaces, Heat Treating, Hardening and Tempering.
Can. Hoskins, Ltd., Walkerville, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Mechanical Engineering Co., 55 Cote St., Montreal, Que.
Tate, Jones & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Forging.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Annealing, etc.
Can. Hoskins, Ltd., Walkerville, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Mechanical Engineering Co., 55 Cote St., Montreal, Que.
Tate, Jones & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces for Baking, Bluing, Drying, Enameling, Japanning and Lacquering.
Oven Equipment & Mfg. Co., New Haven, Conn.

Furnace Lining.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Fuse Cap Machinery.
Noble & Westbrook Mfg. Co., Hartford, Conn.

Gang Planer Tools.
Armstrong Bros. Tool Co., Chicago.
Ready Tool Co., Bridgeport, Conn.

Gaskets, Leather, etc.
Graton & Knight Mfg. Co., Montreal.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Gas Blowers and Exhausters.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Limited, Galt.
Southwark Foundry & Machine Co., Philadelphia, Pa.

Gas Burners.
Oven Equipment & Mfg. Co., New Haven, Conn.

Gas Machines.
Brown, Boggs & Co., Hamilton, Can.

Gas Producer Plants.
Can. Fairbanks-Morse Co., Montreal.

Gauges, Hydraulic Pressure.
Charles F. Elmes Eng. Works, Chicago
Watson-Stillman Co., Aldene, N.J.

Gauges, Standard.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Holden-Morgan Co., Toronto.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Garvin Machine Co., New York.
National Machinery & Supply Co., Hamilton.

Gear-Cutting Machinery.
Girard Machine & Tool Co., Philadelphia, Pa.
Hamilton Gear & Machine Co., Toronto.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
Moteh & Merryweather Machy. Co., Cleveland, O.
National Machinery & Supply Co., Hamilton.
A. R. Williams Machy. Co., Toronto.
Sheldons, Limited, Galt, Ont.
The Smart-Turner Machine Co., Hamilton.
Wm. Tod Co., Youngstown, O.
D. E. Whiton Machine Co., New London, Conn.

Gears, Cut, Mortise, Angle, Worm.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Jones & Glassco, Montreal, P.Q.
Mesta Machine Co., Pittsburg, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Smart-Turner Machine Co., Hamilton, Ont.
Wm. Tod Co., Youngstown, O.

Gears, Rawhide.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal, P.Q.
Philadelphia Gear Works, Philadelphia, Pa.
Smart-Turner Machine Co., Hamilton, Ont.

Generators, Electric.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Lancashire Dynamo and Motor Co. Ltd., Toronto.
Toronto and Hamilton Electric Co., Hamilton.

Grain for Polishing.
Norton Co., Worcester, Mass.

Graphite.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Jos. Dixon Crucible Co., Jersey City.
Stevens, F. B., Detroit, Mich.

Grinders, Automatic Knife.
W. H. Banfield & Son, Toronto.

Grinders, Centre, Pedestal and Bench.
Canadian Hart Wheels, Ltd., Hamilton, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Ford-Smith Machine Co., Hamilton.
Foss & Hill Machy. Co., Montreal.
Gray Mfg. & Machine Co., Toronto.
Niles-Bement-Pond Co., New York.
Modern Tool Co., Erie, Pa.
Morse Twist Drill and Machine Co., New Bedford.
New Britain Machine Co., New Britain, Conn.
Norton Grinding Co., Worcester, Mass.
Stow Mfg. Co., Binghamton, N.Y.
United States Electrical Tool Co., Cincinnati, O.

Grinders, Cutter.
Brown & Sharpe Mfg. Co., Providence, R.I.
Foss & Hill Machy. Co., Montreal.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., Dundas, Ont.

Grinders, Die Chaser.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.

Grinders, Disk.
Armstrong Bros. Tool Co., Chicago, Ill.
Gardner Machine Co., Beloit, Wis.
Norton Grinding Co., Worcester, Mass.

Grinders, Drill.
Garvin Machine Co., New York.
United States Electric Tool Co., Cincinnati, O.

Grinders, Cylinder, Internal.
Brown & Sharpe Mfg. Co., Providence, R.I.
Foss & Hill Machy. Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Greenfield Machine Co., Greenfield, Mass.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Norton Grinding Co., Worcester, Mass.
Rivett Lathe & Grinder Co., Boston, Mass.

Grinders, Electric.
Lintz-Porter Co., Toronto.

Grinders, Pneumatic.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

Grinders, Portable, Electric, Hand, Tool, Post, Floor and Bench.
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Foss & Hill Machy. Co., Montreal.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Greenfield Machine Co., Greenfield, Mass.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Hisey-Wolf Machine Co., Cincinnati, O.
Landis Tool Co., Waynesboro, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Norton Co., Worcester, Mass.
United States Electrical Tool Co., Cincinnati.
A. R. Williams Machy. Co., Toronto.

Grinders, Swing, Portable, Electric.
Hisey-Wolf Machine Co., Cincinnati, O.
United States Electrical Tool Co., Cincinnati.

Grinders, Tool and Holders.
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Machine Co., Greenfield, Mass.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.
Ready Tool Co., Bridgeport, Conn.
Tabor Mfg. Co., Philadelphia, Pa.

Grinders, Universal, Plain.
Girard Machine & Tool Co., Philadelphia, Pa.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.

Grinders, Vertical Surface.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Pratt & Whitney Co., Dundas, Ont.

Grinding and Polishing Machines, Portable, Pneumatic and Spring Frame.
Can. Fairbanks-Morse Co., Montreal.
Canadian Hart Wheels, Ltd., Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Gray Mfg. & Machine Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Hall & Sons, John H., Brantford.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Norton Co., Worcester, Mass.
Stow Mfg. Co., Binghamton, N.Y.

Grinding Wheels.
Can. Fairbanks-Morse Co., Montreal.
Canadian Hart Wheels, Ltd., Hamilton, Ont.
Carborundum Co., Niagara Falls.
Ford-Smith Machine Co., Hamilton, Canada.
Gray Mfg. & Machine Co., Toronto.
Norton Co., Worcester, Mass.

Guards, Window and Machine.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.
Standard Tube & Fence Co., Woodstock, Ont.

Hack Saw Blades.
E. C. Atkins & Co., Hamilton, Ont.
Victor Saw Works, Ltd., Hamilton, Canada.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Racine Tool & Machine Co., Racine, Wis.
L. S. Starrett Co., Athol, Mass.

Hack Saw Frames.
E. C. Atkins & Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Canada.
Garvin Machine Co., New York City.
Mussens, Limited, Montreal.

Hammer High Speed.
High Speed Hammer Co., Rochester, N.Y.

Hammers, Drop and Belt Driven.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton Canada.
Canadian Billings & Spencer, Ltd., Welland.
A. B. Jardine & Co., Hespeler, Ont.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Plessisville Foundry, Plessisville, Que.
Toledo Machine & Tool Co., Toledo.

Hammers, Helve Power.
West Tire Setter Co., Rochester, N.Y.

Hammers, Pneumatic.
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Pittsburg Pneumatic Co., Canton, Ohio.

Hammers, Steam.
John Bertram & Sons Co., Dundas.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.

Hand Hoists & Trolleys.
Whiting Foundry Equipment Co., Harvey, Ill.

Hand Leathers or Pads.
Graton & Knight Mfg. Co., Montreal.

Hangers.
Baird Machine Co., Bridgeport, Conn.
Gardner, Robt., & Son, Montreal.
The Smart-Turner Machine Co., Hamilton.

Hardness Testing Instruments.
Shore Instrument & Mfg. Co., New York.

Heating and Ventilating Engineers.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Ltd., Galt, Ont.

Heat Gauges, Hardening and Annealing.
Shore Instrument & Mfg. Co., New York.

Hinge Machinery.
Baird Machine Co., Bridgeport, Conn.

Hinges.
London Bolt & Hinge Works, London, Ont.

Hoists, Hydraulic.
Southwark Foundry & Machine Co., Philadelphia.
Watson-Stillman Co., Aldene, N.J.

Hoisting and Conveying Machinery.
Northern Crane Works, Walkerville.
Owen Sound Iron Works Co., Owen Sound.
Southwark Foundry & Machine Co., Philadelphia.
Whiting Foundry Equipment Co., Harvey, Ill.

Hoists, Chain, Electric and Pneumatic.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Hoists, Electric.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Hoppers.
Toronto Iron Works, Ltd., Toronto.

Hose Clamp Tool.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Hose, Pneumatic.
Cleveland Pneumatic Tool Co., of Canada, Toronto.

Hose, Steam, Suction and Water.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Holders for Dies and Drills.
Wells Brothers, Company, Greenfield, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Hydraulic Accumulators.
Can. Boomer & Boschert Press Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Wm. R. Perrin Co., Toronto.
The Smart-Turner Machine Co., Hamilton.
Southwark Foundry & Machine Co., Philadelphia.
Watson-Stillman Co., Aldene, N.J.

Hydraulic Machinery.
Can. Boomer & Boschert Press Co., Montreal.
Charles F. Elmes Eng. Works, Chicago.
Niles-Bement-Pond Co., New York.
National Machinery & Supply Co., Hamilton.
Southwark Foundry & Machine Co., Philadelphia.
Wm. Tod Co., Youngstown, O.
Watson-Stillman Co., Aldene, N.J.

Indicators, Speed.
Brown & Sharpe Mfg. Co., Providence, R.I.
L. S. Starrett Co., Athol, Mass.

Index Centres.
Fred. C. Dickow, Chicago, Ill.
Garvin Machine Co., New York.

Ingot Metals.
A. C. Leslie & Co., Ltd., Montreal.

Intensifiers.
Mesta Machine Co., Pittsburg, Pa.

Iron Filler.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Iron Ore.
Hanna & Co., M. A., Cleveland, O.

Jacks, Hydraulic.
Charles F. Elmes Eng. Works, Chicago
Southwark Foundry & Machine Co., Philadelphia.
Watson-Stillman Co., Aldene, N.J.

Jacks.
Can. Fairbanks-Morse Co., Montreal.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Plessisville Foundry, Plessisville, Que.

Jacks, Pneumatic.
Northern Crane Works, Walkerville.

Jacks, Pit and Track.
Can. Fairbanks-Morse Co., Montreal.
Northern Crane Works, Walkerville.
Watson-Stillman Co., Aldene, N.J.

Japanning Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Jaws, Face Plate.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.

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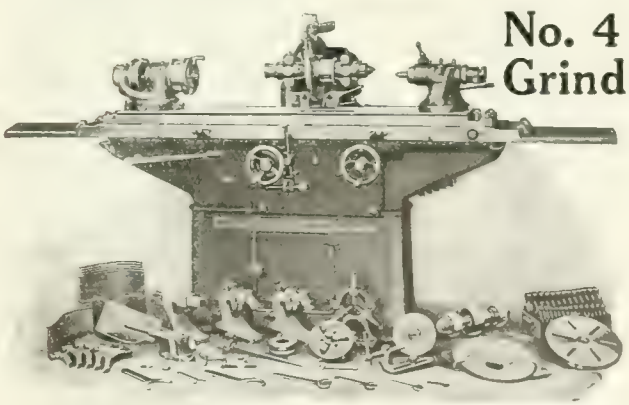
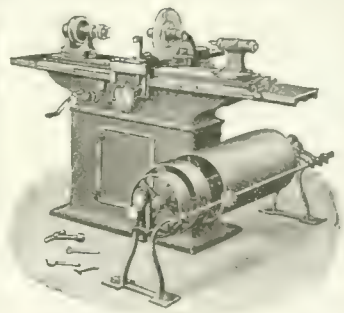


No. 4 Universal Grinding Machine

Will swing work to 12" in diameter and 60" in length.



The First Universal Grinding Machine

Previous to 1876 all Grinders in use were made from lathes with a wheel mounted on the cross slide. This Machine above was invented by J. R. Brown, of J. R. Brown & Sharpe, and was first exhibited at the Centennial Exposition

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Darling Brothers, Montreal.
D'Olier Centrifugal Pump & Mach. Co., Philadelphia, Pa.
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Wm. R. Perrin, Ltd., Toronto.
The Smart-Turner Mach. Co., Hamilton.
Trahern Pump Co., Rockford, Ill.
A. R. Williams Machy. Co., Toronto.
Watson-Stillman Co., Aldene, N.J.

Pumps, Electrically Driven.
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Darling Brothers, Montreal.
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Southwark Foundry & Machine Co., Philadelphia.
Wm. R. Perrin, Ltd., Toronto.
Wm. Tod Co., Youngstown, O.
Watson-Stillman Co., Aldene, N.J.

Pumps, Rotary, for Water and Oil.
Trahern Pump Co., Rockford, Ill.

Pumps for Oiling Systems.
S. F. Bowser & Co., Fort Wayne, Ind.

Pumps, Steam.
Darling Brothers, Montreal.
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Graton & Knight Mfg. Co., Montreal.
Southwark Foundry & Machine Co., Philadelphia.

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Brown, Boggs Co., Ltd., Hamilton, Canada.
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Can. Fairbanks-Morse Co., Montreal.
Scott Bros., Halifax, Eng.
Gardner, Robt., & Son, Montreal.
Globe Machine & Stamping Co.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Toledo Machine & Tool Co., Toledo, O.

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John Bertram & Sons Co., Dundas,
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton Canada.
Girard Machine & Tool Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Watson-Stillman Co., Aldene, N.J.

Punches, Pneumatic.
Jno. F. Allen Co., New York.

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Bertrams, Ltd., Edinburgh, Scotland.
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Bliss, E. W., Co., Brooklyn, N.Y.
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Niles-Bement-Pond Co., New York.

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Watson-Stillman Co., Aldene, N.J.

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Stevens, F. B., Detroit, Mich.

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Keystone Mfg. Co., Buffalo, N.Y.

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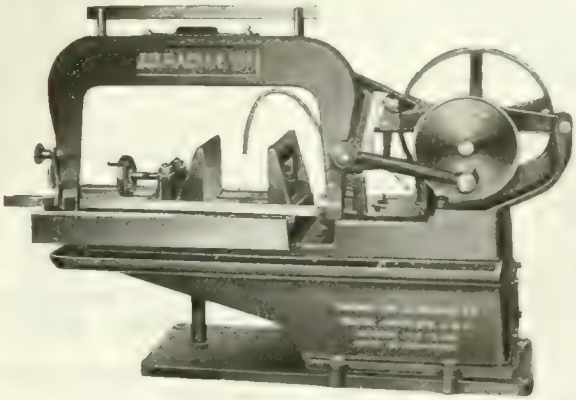

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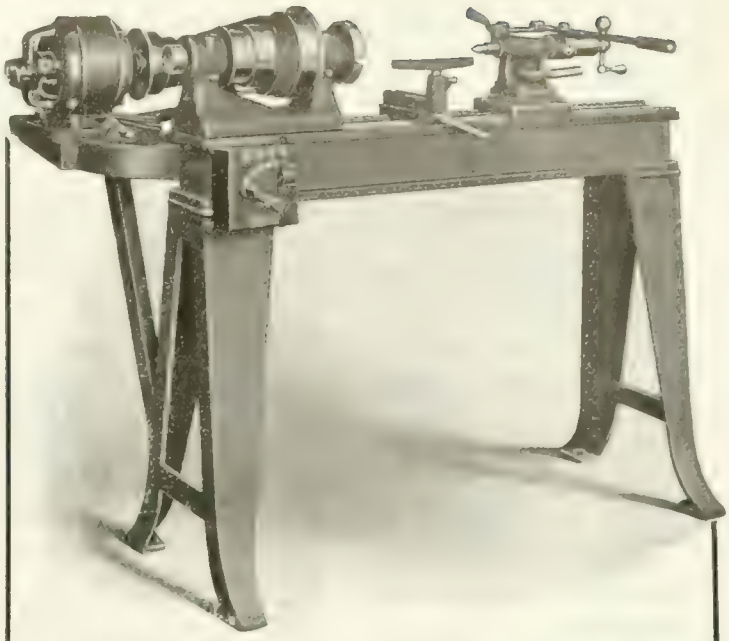

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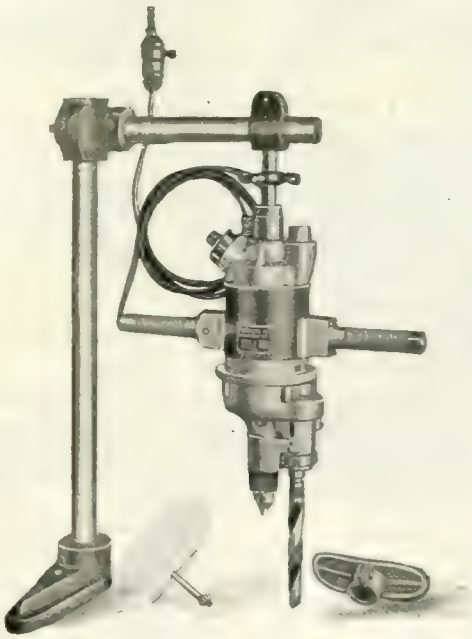

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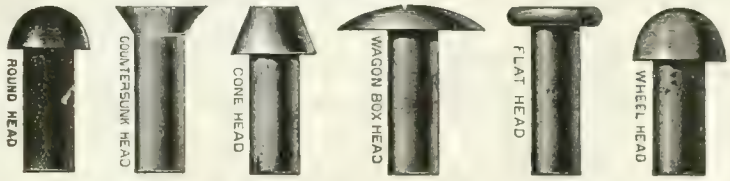

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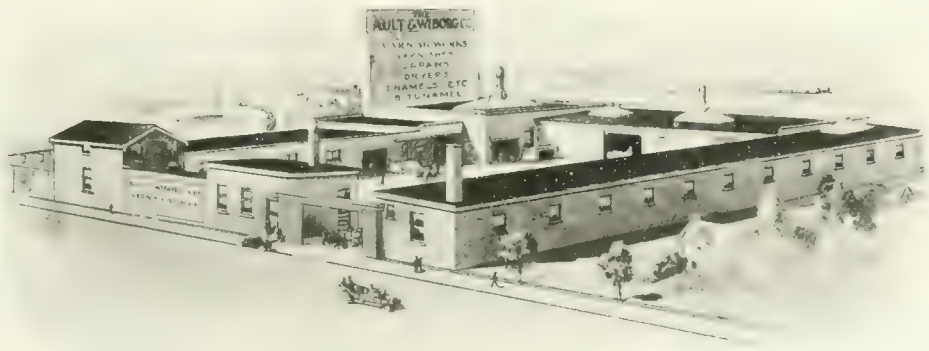

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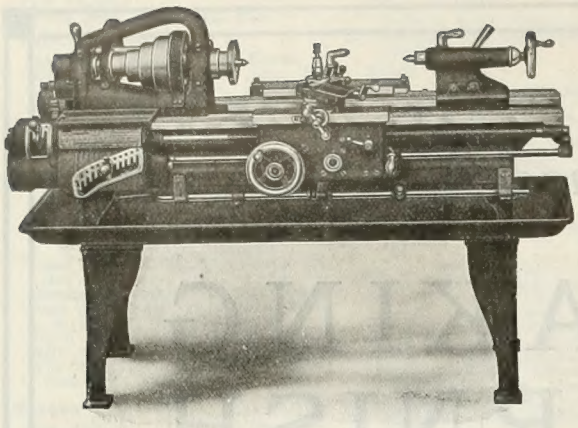

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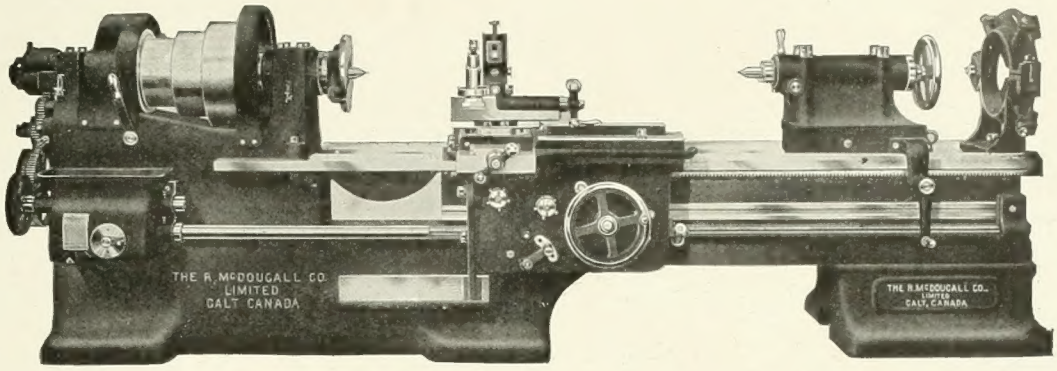

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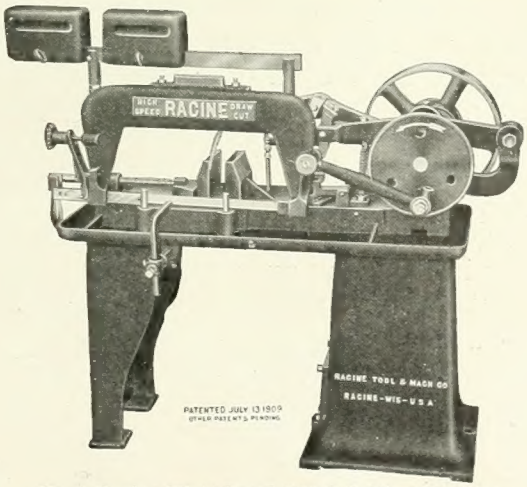

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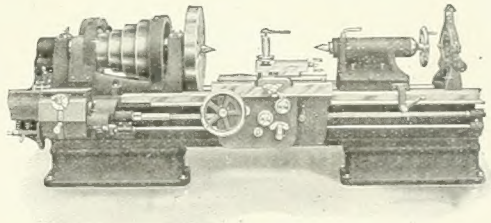

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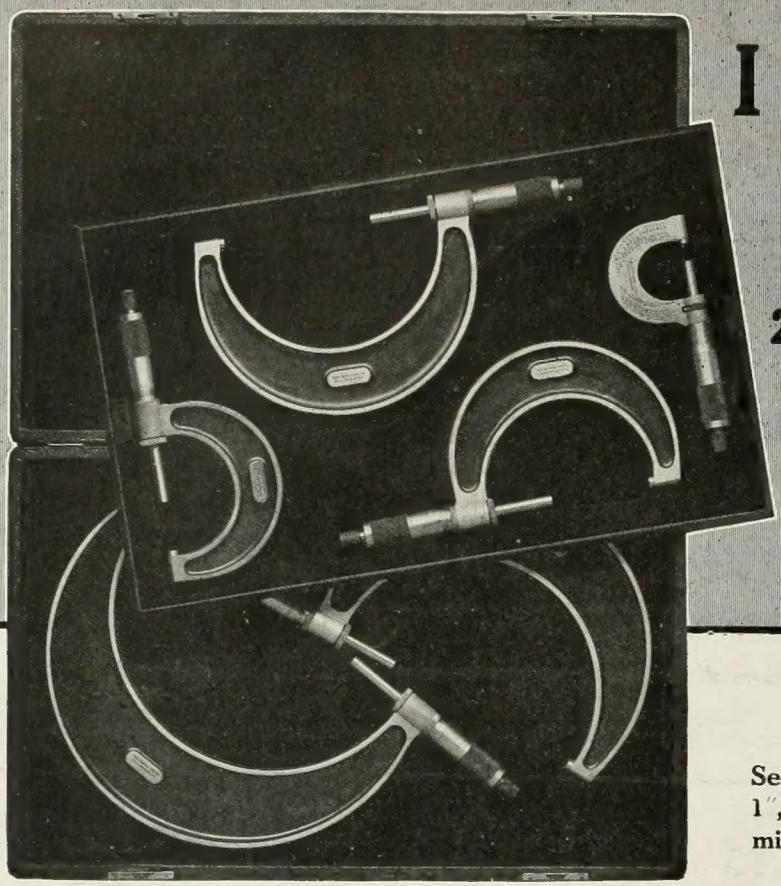

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